# Longspine Thornyhead Random Stratified Trawl Survey off the West Coast of Vancouver Island, September 4-21, 2003

B.A. Krishka, P.J. Starr, and E M. Choromanski

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, B.C.
V9T 6N7

2005

**Canadian Technical Report of Fisheries and Aquatic Sciences 2577**

Fisheries and Oceans | Pêches et Océans

Canada

**Canadian Technical Report of**
**Fisheries and Aquatic Sciences**

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1 - 456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457 - 714 were issued as Department of the Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

**Rapport technique canadien des**
**sciences halieutiques et aquatiques**

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais que ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les scences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annual des publications scientifiques et techniques du Ministère.

Les numéros 1 à 456 de cette série ont été publiés à titre de rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Les rapports techniques sont produits à l'échelon regional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

105-04193/

Canadian Technical Report of

Fisheries and Aquatic Sciences 2577

2005

# LONGSPINE THORNYHEAD RANDOM STRATIFIED TRAWL SURVEY OFF THE WEST COAST OF VANCOUVER ISLAND, SEPTEMBER 4-21, 2003

by

B. A. Krishka[1], P. J. Starr[2], and E. M. Choromanski[1]

[1]Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, B.C.
V9T 6N7

[2]Canadian Groundfish Research and Conservation Society
1406 Rose Ann Drive
Nanaimo, B.C.
V9T 4K8

© Her Majesty the Queen in Right of Canada, 2005
Cat. No. Fs 97-6/2577E ISSN 0706-6457

Correct citation for this publication:

Krishka, B.A., Starr, P.J., and Choromanski, E.M. 2005. Longspine thornyhead random stratified trawl survey off the West Coast of Vancouver Island, September 4-21, 2003. Can. Tech. Rep. Fish. Aquat. Sci. 2577: vi + 93 p.

## TABLE OF CONTENTS

ABSTRACT ..... v
RÉSUMÉ ..... vi
List of Tables ..... iv
List of Figures ..... iv
INTRODUCTION ..... 1
Survey Objectives ..... 1
METHODS ..... 1
Stratum Definitions ..... 2
Vessel and Equipment ..... 2
Tow Selection ..... 4
Catch and Sample Processing ..... 5
Data Analysis ..... 5
RESULTS AND DISCUSSION ..... 7
Tow Frequency and Distribution ..... 7
Net Mensuration ..... 8
Bottom Contact Sensor Data ..... 9
Catches and Catch Rates ..... 10
Biological Data ..... 10
Biomass Estimation ..... 11
Comparison with Previous Survey Biomass Estimates ..... 11
RECOMMENDATIONS ..... 12
CONCLUSION ..... 12
ACKNOWLEDGEMENTS ..... 13
REFERENCES ..... 13
Tables (begin) ..... 14
Figures (begin) ..... 29
APPENDICES ..... 43
Appendix A. Design for the 2003 west coast Vancouver Island thornyhead survey ..... 43
Appendix B. Flatfish gonad condition and maturity stages ..... 61
Appendix C. Rockfish (*Sebastes* spp.) gonad condition and maturity stages ..... 62
Appendix D. Wingspread estimation from wingspread/doorspread paired observations ..... 63
Appendix E. Bridge log and haul information by tow for the 2003 thornyhead survey ..... 67
Appendix F. Date, time and position information added to existing Nobeltec track data ..... 93

## LIST OF TABLES

Table 1. Names and labels for seven area strata and three depth zone strata ..... 14
Table 2. Biological sampling targets for selected fish species ..... 14
Table 3. Summary of selected information for valid tows ..... 15
Table 4. Tows that were attempted and excluded from analyses ..... 17
Table 5. Summary of reasons for rejecting selected tow sites ..... 17
Table 6. Summary of selected gear and tow statistics by depth zone for valid tows ..... 18
Table 7. Time delays for first and last gear contact with bottom for valid tows ..... 19
Table 8. Species caught in 66 valid tows ..... 20
Table 9. Species caught in 8 rejected tows ..... 22
Table 10. Numbers of samples and biological attributes collected from valid tows ..... 23
Table 11. Additional biological attributes measured from two rejected tows ..... 24
Table 12. Sablefish tags recovered during the 2003 survey ..... 24
Table 13. Length statistics and sample frequency by depth zone ..... 25
Table 14. 2003 biomass estimates for selected species using two time spans ..... 26
Table 15. 2003 thornyhead and sablefish biomass by stratum ..... 27
Table 16. Relative biomass estimates for 2001-2003 (fixed wingspread, areas A-F only) ..... 28
Table 17. Biomass estimates from 2002-2003 for the total survey (areas A-G) ..... 28

## LIST OF FIGURES

Figure 1. Vancouver Island coastal waters showing survey area, depth strata and tow sites ..... 29
Figure 2. Net specifications for the Atlantic Western II box trawl ..... 30
Figure 3. Frequency distributions of tow distances (km) by depth stratum ..... 31
Figure 4. Time delays for gear contact with bottom following winch lockup and release ..... 31
Figure 5. Bottom contact sensor profiles from the 2003 survey ..... 32
Figure 6. Unscaled size distributions by species from biological samples ..... 36
Figure 7. Regression plots of weight vs. length for six species ..... 39
Figure 8. Biomass estimates for 13 species from the 2003 survey ..... 40
Figure 9. Comparable biomass estimates for 13 species from the 2002 and 2003 surveys ..... 41

## ABSTRACT

Krishka, B.A., Starr, P.J., and Choromanski, E.M. 2005. Longspine thornyhead random stratified trawl survey off the West Coast of Vancouver Island, September 4-21, 2003. Can. Tech. Rep. Fish. Aquat. Sci. 2577: vi + 93 p.

The third of three initial relative biomass surveys for longspine thornyheads off the west coast of Vancouver Island, British Columbia, was completed September 4-21, 2003 covering a depth range from 500 to 1600 m. The 2003 survey design was very similar to that used for the 2002 survey, covering the same depth and area strata. The only major change substituted a randomized method of gathering species biological data for the length-stratified subsampling method used in 2001 and 2002. Bottom contact sensors identified when the net made contact with bottom and supplied the primary measure of tow duration for CPUE estimation. Net mensuration data during each tow were manually logged for the first 36 tows and a live serial data feed captured these data for tows 37-74. Sixty-six of the 74 tows were considered valid for biomass estimation, with 86% of the total catch weight of 24.1 tonnes consisting of six species (sablefish *Anoplopoma fimbria*, roughscale rattail *Coryphaenoides acrolepis*, longspine thornyhead *Sebastolobus altivelis*, shortspine thornyhead *Sebastolobus alascanus*, pectoral rattail *Albatrossia pectoralis* and Dover sole *Microstomus pacificus*). Biological samples were gathered from 18 species, with 312 of the 437 samples coming from the six most abundant species by weight. The relative biomass estimate for longspine thornyhead was 4,971 t with a relative error of 11% and is very similar to the 2002 estimate of 4,985 t. Biomass estimates for most of the other top 10 species by weight also had relative errors below 20%, suggesting that this survey also has the capacity to index other groundfish species.

## RÉSUMÉ

Krishka, B.A., Starr, P.J., and Choromanski, E.M. 2005. Longspine thornyhead random stratified trawl survey off the West Coast of Vancouver Island, September 4-21, 2003. Can. Tech. Rep. Fish. Aquat. Sci. 2577: vi + 93 p.

La troisième des trois campagnes de relevés de la biomasse relative de sébastolobe à longues épines sur la côte ouest de l'île de Vancouver (Colombie-Britannique) a été réalisée du 4 au 21 septembre 2003; elle couvrait une gamme de profondeurs allant de 500 m à 1 600 m. La campagne de 2003 était conçue de façon très semblable au relevé de 2002, et couvrait les mêmes strates de profondeur et de région géographique. La seule différence importante a été le remplacement de la méthode de sous-échantillonnage stratifié selon la longueur, employée en 2001 et 2002, par une méthode randomisée de collecte de données biologiques sur les espèces. Des capteurs de contact avec le fond signalaient que le filet touchait le fond et fournissaient la première mesure de durée des traits pour l'estimation des CPUE. Pour les 36 premiers traits, on a consigné à chaque fois, manuellement, les mesures sur la performance du train de pêche, puis on a eu recours à la saisie directe des données en série pour les traits 37 à 74. Soixante-six des 74 traits ont été jugés valides pour l'estimation de la biomasse, 86 % du poids total des prises de 24,1 tonnes consistant en six espèces (morue charbonnière *Anoplopoma fimbria*, grenadier à écailles rudes *Coryphaenoides acrolepis*, sébastolobe à longues épines *Sebastolobus altivelis*, sébastolobe à courtes épines *Sebastolobus alascanus*, grenadier pectoral *Albatrossia pectoralis* et sole à petite bouche *Microstomus pacificus*). Des échantillons biologiques ont été prélevés sur 18 espèces; 312 des 437 échantillons provenaient des six espèces les plus abondantes en poids. L'estimation de la biomasse relative de sébastolobe à longues épines était de 4 971 t, avec une erreur relative de 11 %, ce qui est très proche de l'estimation de 2002, soit 4 985 t. Les estimations de la biomasse pour la plupart des dix autres principales espèces (en poids) présentaient aussi des erreurs relatives inférieures à 20 %, ce qui permet de penser que ce relevé a aussi la capacité d'indexer d'autres espèces de poissons de fond.

## INTRODUCTION

Thornyheads in BC waters have been targeted commercially for over a decade and first appeared as incidental catches in commercial catch records in 1966. Schnute et al. (2004) provide a concise history of the longspine fishery.

Following the identification of longspine thornyhead (*Sebastolobus altivelis*) and shortspine thornyhead (*S. alascanus*) as good candidates for research survey biomass estimation off the BC coast (Schnute et al. 1999), Starr and Schwarz (2000) proposed using a random stratified trawl survey design for these species. Consultation with industry stakeholders, government and academic representatives refined the design which was implemented beginning in 2001 off the west coast of Vancouver Island.

The design, methods and preliminary results of the 2001 survey are found in Starr et al. (2002). The 2002 survey report (Starr et al. 2004) documents the addition of a seventh areal stratum (Region G - Quatsino), revised sampling strategies and targets, plus a comparison of the 2001 and 2002 results. Relative error estimates of thornyhead biomass for both surveys were well below the design target of 20% and the survey generated very similar relative biomass estimates in both years. The survey also appears to have utility as an index for other groundfish species such as sablefish (*Anoplopoma fimbria*) and two non-exploited rattail (grenadier) species.

The 2003 Thornyhead Biomass Survey is the final survey of a planned series of three surveys over the period 2001 to 2003. The F/V *Ocean Selector* completed the 2002 and 2003 surveys while the F/V *Viking Storm* carried out the initial survey in 2001. Changes in 2003 to the survey protocol include improved electronic data capture methods and a random methodology to select biological subsamples.

## SURVEY OBJECTIVES

The 2003 survey objectives remain the same as previous years, namely:

1. To estimate the relative abundance of longspine thornyhead lying between a southern boundary defined by the Canada-US border north to 50° 30' N within the 500-1,600 metre depth range. The target relative error of the longspine thornyhead biomass estimate is 20% $\left(RE = SE/\mu\right)$ (where $\mu$ is the biomass estimate from the survey and $SE$ is the standard error of that estimate).
2. To estimate the distribution by size class and sex category of the longspine thornyhead population within the extent of the survey area, given the uncertainty that results from sampling with non-representative fishing gear.
3. To obtain quantitative biological information pertaining to selected finfish and invertebrate species.

## METHODS

The methods used to collect the 2003 survey data follow the revised survey protocol detailed in Appendix A. We paraphrase the protocol below and note any differences. Buchanan and Orcutt (2004) also provide additional details within their internal report that may clarify sampling issues.

## STRATUM DEFINITIONS

Survey strata comprise three depth zones (501-800 m, 801-1200 m, 1201-1600 m) and seven area zones (areas A-G) that cover the entire designated southern management area for longspine thornyhead off the west coast of Vancouver Island (DFO 2002; Figure 1). Twenty-one unique stratum combinations exist, with associated estimates of surface area and trawlable area (Table 1). Surface area estimates are derived from interpolated depth contours for BC waters. Areas of rough terrain and known obstacles in areas A-F were designated "untrawlable" based on advice obtained prior to the 2001 survey (Chris Roberts, commercial fishing skipper, pers. comm.). Trawlable area in these six strata is the stratum surface area minus the untrawlable area. Area G (Quatsino) was added to the survey design in 2002 without specifying untrawlable areas. Therefore the trawlable area for stratum G is equal to the stratum surface area.

## VESSEL AND EQUIPMENT

The Canadian Groundfish Research and Conservation Society (CGRCS) chartered the commercial fishing vessel F/V *Ocean Selector* for the current survey, with Dave Clattenberg as skipper and fishing master again in 2003. The same vessel also completed the 2002 survey. Paul Starr (CGRCS) began the 2003 cruise as chief scientist and remained aboard for the first five days. Archipelago Marine Research Ltd. (AMR) supplied two staff (Dean Gaidica, Mike Orcutt) for catch and sample processing, while Fisheries & Ocean Canada (DFO) staff included Ed Choromanski who supervised catch sampling, and Brian Krishka as chief scientist in Paul Starr's absence. CGRCS contractor Nev Venables also came aboard to assist with sampling after the departure of Paul Starr. Daily communication via email and/or telephone kept Paul Starr informed of survey progress.

A standard Atlantic Western II box trawl (Figure 2; similar to the net used to capture thornyheads commercially) was purchased in 2001 specifically for this survey so that gear differences could be minimized among years. A second box trawl, constructed in 2002 for use aboard the F/V *Ocean Selector*, was supposed to have been built to the same specifications as the first net and was used for the 2002 survey. However, as a result of the change in survey vessel between 2001 and 2002, some differences arose in the way the net was constructed and rigged between these two years. The trawl nets aboard the F/V *Viking Storm* used a lighter footrope, less buoyancy on the headrope, shorter sweep wires and heavier warp cables (G. Workman, DFO, Nanaimo, pers. comm.). The survey planning team was not aware of these changes until the start of the 2003 survey. At that time, skipper Dave Clattenberg indicated that, in his opinion, these changes would have a very minor effect on longspine catchability. The same doors (Thyboron 107) were used in all three survey years. Schnute et al. (2004) incorrectly noted that different doors were used across survey years. The trawl net used in 2003 conformed to the 2002 configuration. Nevertheless, differences in the net design and configuration between 2001 and subsequent years have introduced a catchability change that cannot be quantified, as did the change in the survey vessel between 2001 and 2002.

The F/V *Ocean Selector* was equipped with SCANMAR net monitoring equipment (Scanmar AS, Norway, http://www.scanmar.no/) which displayed fishing characteristics of the net while a tow was in progress. Four sensors mounted on the net, plus associated receiver and processing equipment on the bridge provided real-time data for doorspread, headline height, water temperature at the net, water flow through the net, relative angle, and net depth. Wingspread measurements were not obtained in 2003 since only one Scanmar distance sensor was available. The vessel manager and the survey leader agreed to install this sensor on the

trawl doors to provide doorspread readings. The Scanmar depth sensor was attached to the headrope, requiring that headline height values be added to the sensor depth readings to obtain true depth. The depth sensor failed to record depths beyond 1240 m because the factory settings limited the sensor's range. Scanmar depth sensors are capable of recording greater depths when properly configured, but the sensor must be returned to Scanmar in Norway for adjustment. The Scanmar sensor that measured net speed and alignment was installed backwards on the net until the morning of Sept. 9th, providing incorrect water flow values through the net for tows 1-21. Resulting flow values for these tows should be ignored.

Continuous electronic data capture from the SCANMAR equipment was not established until halfway through the 2003 survey due to difficulties in obtaining the correct software in time for the vessel sailing. Frequent screen-captures of the SCANMAR display during this first part of the survey were used to provide a record of the sensor readings, using software which saved the display image as a compressed bitmap file. Screen captures were taken every 1-2 minutes from the time of winch lockup to the time that the net finally left bottom. Consecutive screen captures were not correctly incremented for some tows, which caused some of the initial files to be overwritten on the floppy disc until the problem was identified.

Electronic data capture was implemented beginning with tow 37 after installing a Furuno interlacer that merged serial output signals from the Global Positioning System (GPS) and SCANMAR sensors. Technicians from Port Hardy met the vessel in Winter Harbour to complete the interlacer installation. HyperTerm software captured the resulting serial data flow as a separate text file for each tow.

Manual Scanmar screen captures were continued at a reduced level for tows 37 to 74 as a backup in case electronic data capture failed. Screen captures for these tows were made 1) when net sensor readings indicated that the net reached bottom, 2) every 5-10 minutes during the tow, 3) when the winch released for net retrieval, and 4) when the net finally left bottom. The SCANMAR sensors and GPS recorded the following information at each interval: time, bottom depth, latitude, longitude, warp length, wind speed, wind direction, vessel direction and vessel towing speed. Post-survey transcription of the screen-capture data and the HyperTerm serial data are included as supplemental information in the DFO GFBio data archive for Trip_ID 50220.

Nobeltec navigational software (Visual Navigation Suite) captured tow track information (location, vessel speed and direction, time) that enabled visual presentation of the vessel path during each tow. Normally the vessel skipper would begin logging the vessel position using this software at the time when the winch was locked to begin fishing, and then stop logging the position data when net retrieval began. Each tow track was identified with the set number. Incomplete tracks were occasionally recorded for some tows because the skipper failed to either start or stop tracking the tow at the required time. Post-survey manual editing of track data corrected for incomplete tracks by 1) adding coordinates for the start location based on bridge log records, and 2) removing extraneous data when the software continued logging position after the tow ended. Ideally, GPS sensors should be attached directly to the trawl net, logging true net location with time, but the current proxy is to use the vessel path information.

A bottom contact sensor (BCS) was deployed with each survey tow to measure the effective tow time, defined as the time difference between the points at which the net made first and last contact with bottom during a tow. Acceptable tows within areas A-D needed at least 30 minutes of effective tow time, with 15 minutes or more required in areas E-G. The sensor attached below the trawl footrope using two short chains, and an internal inclinometer recorded tilt angle of this device (0° = vertical, 90° = horizontal). Chains used to attach the BCS were shortened from the 8 links used in 2002 to 6 links for 2003 to reduce the variability in the bottom

contact readings. A rapid change in angle from 0° toward 90° was interpreted to indicate net contact with the bottom as the sensor began dragging horizontally behind the footrope (M. Wilkins, NFMS, pers. comm.). The sensor would hang vertically (reading near 0°) beneath the footrope whenever the net was off the bottom. A data logger installed within the BCS device recorded time and tilt angle every 6 seconds and was synchronized with the GPS clock each morning. Following each tow, BCS data were transferred to an onboard computer and the data logger memory was purged in preparation for the next tow. BCS data exist for all tows except for tow 51 (the BCS device was lost during this tow) and tow 69 (aborted before net reached bottom). These data are archived as supplemental data for GFBio Trip_ID 50220.

A Seabird depth-temperature sensor (Model # SEB 39) was used to gather continuous temperature and depth data throughout the day. It was attached to the headrope within a protective housing and was retrieved every 2-3 tows to download data and clear sensor memory. All Seabird data are archived at the Institute of Ocean Sciences (DFO, Sidney, B.C.) and also as supplemental data for GFBio Trip_ID 50220.

## TOW SELECTION

The survey area was divided into 500 m x 500 m square grids which were assigned unique station numbers. Potential tow locations for each area/depth stratum were based on a random pre-selected list of 25 station numbers. Tows were performed in sequential order from the list (1 to 25) until the required number of tows was completed. Survey protocol required investigation of the first four stations on the list for strata in shallower depth ranges (501-800 m and 801-1200 m), while only the first two stations needed investigation in the deep (1201-1600 m) stratum.

The skipper was allowed to fish any tow line in survey areas A through D that passed within 250 m of the designated random station at some point during the tow, as well as maintaining at least 30 minutes of effective tow time within the required depth range. Random locations could be skipped in favour of the next random station on the list if:

- The station did not meet the area/depth stratum definition (e.g., the depth of the random station was not within the specified depth zone or the station was outside the area boundaries); OR
- The station was considered untrawlable due to bottom topography or other obstacles such as known snags. The skipper was encouraged to select another station if there was a significant danger of either losing the net or not achieving adequate bottom contact time.

The tow location selection rules were relaxed for the three northern areas (E, F and G) as the bottom topography in these areas is much less suitable for bottom trawl gear. The skipper was allowed to select any location in the 25 random grids that was deemed trawlable. Bottom contact requirements were also relaxed to a minimum of 15 minutes bottom contact time and the vessel had to pass within 2 km of the random station at some time during the tow.

Depth contours available in the survey grid database are only approximate and the primary determinant of depth occurred as the survey progressed. Deviations from plotted depth contours were not considered a problem, as all valid tows were located within the appropriate depth zones.

Additional random sites were required for areas E (501-800 m zone in Esperanza) and F (1201-1600 m zone in Cape Cook–Winter Harbour) after the initial lists of 25 potential sites were either used or rejected without achieving the target number of tows per stratum.

## CATCH AND SAMPLE PROCESSING

Catches were released into the hopper on deck and transferred along a conveyor belt to the sampling area. The sampling crew stationed along the belt sorted species or species groups into separate sampling baskets for bulk weighing. All species had specimens counted, if practical, and a total weight recorded by species. Eleven "target" species required detailed sampling that varied between species (Table 2). All specimens of a target species were measured unless the species catch consisted of more than 150 individuals, in which case subsampling took place. Catches were randomly subsampled in proportion to the estimated number of fish caught, so that a manageable number of fish was processed for required attributes. For example, one in every six fish was sampled if 600 fish were estimated in the species catch, providing a subsample of approximately 100 specimens. The procedure was repeated with a larger proportion if the initial sub-sample was too small.

A large capacity motion-compensating electronic balance (Marel Model M1100) provided weights of species catches within each basket to estimate the total catch by species. A smaller balance was used to measure weight from individual specimens being sampled for otoliths.

Eight target species (Table 2) had maturity stages recorded using established maturity codes for flatfish (Appendix B) and rockfish (Appendix C). A simplified maturity code scheme continued to be used for thornyheads in 2003 (0 = immature, 1 = mature) which was consistent with the maturities taken for these species in the 2001 and 2002 surveys (Appendix A1).

The method for selecting subsamples for ageing structures, weights and maturity information changed in 2003 from a length-stratified scheme (Starr et al. 2004) to direct random sampling by tow. This was accomplished through a series of random number tables (see Appendix A2 for an example) that indicated which fish in the series should be sampled. These tables were constructed based on the numbers of fish in the sample and overall survey targets for the species in question (Table 2).

## DATA ANALYSIS

Only tows which were considered to have met the requirements for site suitability and bottom contact time were used to estimate target species biomass. Equations 2, 3, 5 and 6 below have been modified from Appendix D in Starr et al. (2002) to accommodate estimates of wingspread available from Scanmar net sensor data. Actual wingspread values are not available for 2003 since the vessel used the available Scanmar distance sensor to gather doorspread measurements (see pg. 3). Wingspread values for 2003 are estimated from a relationship between wingspread and doorspread derived from 2002 survey data when both measurements were available (Appendix D).

The biomass estimate ($B_s$) for species $s$ from the survey was calculated in kg as follows:

$$B_s = \sum_i C_{s_i} A_i \qquad \textbf{Eq. 1}$$

where $C_{s_i}$ = mean CPUE density (kg/km$^2$) for species $s$ in stratum $i$

$A_i$ = area of stratum $i$ (km$^2$)

The variance of the survey biomass estimate $V_{B_s}$ for species $s$ was calculated in kg$^2$ as follows:

$$V_{B_s} = \sum_i {V_{s_i} A_i^2} / {n_i} \qquad \textbf{Eq. 2}$$

where $V_{s_i}$ = variance of CPUE (kg$^2$/km$^4$) for species $s$ in stratum $i$

$n_i$ = number of observations in stratum $i$

Tow distance is estimated by summing the distance traveled within time intervals during each tow. Interval data are obtained from either Scanmar screen captures or live data feeds via serial outputs from the Scanmar system and Nobeltec software linked to the onboard GPS. The distance traveled in km ($D_{ij}$) by tow $j$ in stratum $i$ was calculated from intermediate observations within a tow:

$$D_{ij} = \sum_t S_{ijt} T_{ijt} \qquad \textbf{Eq. 3}$$

$S_{ijt}$ = speed (km/h) for tow $j$ in stratum $i$ over time interval $t$
$T_{ijt}$ = length of time interval $t$ (h) for tow $j$ in stratum $i$

Note that $S_{ijt}$ is defined as the mean of the vessel speed observation from the start and end of each interval $t$.

$C_{s_i}$ (Catch per unit area (kg/km$^2$) for species $s$) for the 2003 survey is then calculated as:

$$C_{s_i} = \frac{\sum_j \left( {W_{s_{ij}}} / {D_{ij} w_{ij}} \right)}{J_i} \qquad \textbf{Eq. 4}$$

where $W_{s_{ij}}$ = catch weight (kg) for species $s$ in stratum $i$ and tow $j$

$w_{ij}$ = wingspread width in km for tow $j$ in stratum $i$

$J_i$ = number of tows in stratum $i$

The precision of the survey is often expressed in terms of the relative error ($RE$) which is estimated from the values obtained in Eq. 1 and Eq. 2:

$$RE_{B_s} = \frac{\sqrt{V_{B_s}}}{B_s} \qquad \textbf{Eq. 5}$$

where $RE_{B_s}$ is the relative error for the biomass index for species $s$.

The relationship of weight from length is usually expressed as follows (Quinn & Deriso 1999):

$$Z_{sijk} = a_s L_{sijk}^{b_s} e^{\varepsilon_{sijk}} \qquad \textbf{Eq. 6}$$

where $Z_{sijk}$ is the weight of observation $k$ of species $s$ with length $L_{sijk}$ from tow $j$ in stratum $i$, $a_s$ and $b_s$ are species regression constants and $e_{sijk}$ is a random error term with mean 0 and constant variance $s^2$.

The sample for any species was scaled up to the catch in the sampled tow as follows:

$$S_{sijk} = \frac{Z_{sijk}}{\sum_k Z_{sijk}} W_{s_{ij}} \qquad \textbf{Eq. 7}$$

where $S_{sijk}$ is the scaled weight (in kg) of observation $k$ of species $s$ from tow $j$ in stratum $i$.

As $S_{sijk}$ is equivalent to the catch weight $\left(W_{s_{ij}}\right)$ in Eq. 4, $S_{sijk}$ can be substituted into these equations instead of $W_{s_{ij}}$ and then the corresponding CPUE estimate can be used in Eq. 1 and Eq. 2 to calculate the mean and standard error of any sub-group of the biomass. Length distributions were calculated by binning the lengths into 1-cm intervals for longspines and into 5-cm intervals for shortspines, the two rattail species and Dover sole.

## RESULTS AND DISCUSSION

### TOW FREQUENCY AND DISTRIBUTION

The survey was completed in 16 fishing days from September 5-20th. From two to seven acceptable tows were completed each day, averaging 4.2 per day. No fishing days were lost due to weather, but several days were shortened so that serial communication with the Scanmar net sensors could be established.

Seventy-four tows were attempted, of which 66 were accepted for calculating species biomass indices and 8 were rejected (Figure 1; Tables 3 and 4). Tows were aborted for several reasons including gear malfunctions, snagged bottom or communications line, and one tow that dropped below the maximum allowable depth (Table 4).

Table 5 summarizes 110 random tow locations that were not selected and the reasons for rejection. Forty-five percent of the random tow locations were rejected because of steep or irregular bottom topography; most of these came from the three northern areas. On-site depth verification identified actual site depths that were outside stratum limits, therefore rejecting another 36 tow locations. This is a common reason for rejecting sites since the depth contours used for depth stratification are not exact. Areas E-G sites represent 84% of all rejected sites.

## NET MENSURATION

Streaming Scanmar net sensor data could not be collected during the first half of the 2003 survey. As explained earlier (pg. 3), technicians established a working system of streaming data capture between the Scanmar system, GPS and survey computers just prior to tow 37. This resulted in continuous Scanmar sensor and GPS position information for all tows beginning with tow 37.

Survey staff noticed a problem with Scanmar depth sensor data partway through the survey but were unable to correct the situation during the survey. Factory settings on the depth sensor prevented measurement of depths beyond 1240 m. Unfortunately, the sensors needed to be returned to Scanmar in Norway to adjust the sensor limit and this was not practical during the survey. This quirk only affected depth measurements in the deepest depth strata (1201-1600 m). Seabird temperature and depth data are available to compensate for missing Scanmar depth data for 11 of the 14 deepest tows. The Seabird sensor also malfunctioned at times due to problems with weak batteries and poor connections.

Total distance traveled by the net was estimated in several ways. The method used for the previous two surveys involved estimating the distance traveled for each time interval based on the interval speed and the elapsed time, with the total distance traveled being the sum of these distances. Interval calculations in 2002 began from winch lockup and ended at winch release while interval distances were calculated in 2003 beyond the point of winch release. This manner of estimation was continued in 2003 so that the methodology used to estimate distance traveled (Eq. 3) was consistent for all three survey years.

Nobeltec navigational software permitted an independent measure of tow track length based on positional coordinates taken at 1-minute intervals. Data points (time and position) were manually added to tow tracks if vessel tracking actually began after winch lockup or ended before the winch release time recorded on bridge logs (Appendix F). Data filtering eliminated extraneous information gathered before the winch lockup time and after the winch release time, allowing estimates of tow length to be made directly from the Nobeltec data. Track length estimates derived using PBSMapping software (Schnute et al. 2003) confirmed Nobeltec distance calculations. Future data collection should ensure that Nobeltec tow tracks capture the entire tow distance by recording position data for the period beginning several minutes before winch lockup and continuing to the time when the net leaves the bottom after winch release.

Regardless of the methodology used to estimate tow distance, two types of tow distance estimates can be made: one spanning the period from winch lockup to winch release ("winch time") and the other spanning the period from the time the net reached the bottom to the time the net left the bottom ("bottom contact time") as specified by the BCS devices attached to the net.

Tow distances based on winch time, using either Scanmar or Nobeltec data, provide slightly longer distance estimates than those based on bottom contact time (Table 6). The preferred distance estimate to use for biomass estimation should be based on the bottom contact time because this time period best represents the actual time that the gear is fishing on bottom even though the net appears to leave bottom for variable periods during many tows (Figure 5). However, bouncing on the bottom will affect all of the available sources for distance measurement.

The frequency distribution of distance traveled for valid tows shows that the majority of tows traveled between 3.5 and 6 km (Table 6; Figure 3) which was similar to the range of distances observed in previous surveys. The range of estimated tow distances based on winch time span (3.3-6.6 km) is slightly wider than the range based on bottom contact (3.1-6.3 km).

Mean tow distance decreases with depth zone regardless of the method used to estimate tow distance (Table 6).

Average tow speed varied from 3.3 to 5.8 km/h (Table 6). The average vessel speed for 2003 (4.6 km/h) was similar to the 2002 survey (4.6 km/h) and higher than the mean for the 2001 survey (4.2 km/h) (Starr et al. 2002, 2004). Mean vessel speed decreased with increasing depth (Table 6).

Wingspread measurements were not available from Scanmar sensors during the 2003 survey while doorspread and headline height data were available. In the absence of 2003 wingspread readings, median doorspread values by tow were converted to the equivalent wingspread value based on a relationship of wingspread-to-doorspread estimated from 2002 survey data (Appendix D). These data indicate that the relationship between these two net dimensions can be quite variable during a tow (Fig. 1 in Appendix D) but that there is stability in the median values. The wingspread-to-doorspread functional relationship is based on 758 paired observations with a high level of correlation ($R^2 = 0.998$) which provides a reasonable level of comfort in making this adjustment. However, the obvious preference would be to have enough Scanmar distance sensors to collect both wingspread and doorspread measurements during future surveys.

Additional information gathered by net sensors included the flow of water through the net opening. An incorrectly installed flow meter in the trawl net gave invalid readings for the first 21 tows. Once the error was noticed, the deck crew correctly mounted the meter to the net for subsequent tows. No analysis of flow data was done for this report but the data are archived in GFBio for future consideration.

## BOTTOM CONTACT SENSOR DATA

Bottom contact sensor data permit the calculation of the length of time required for the net to reach the bottom after the winch is locked and the length of time it takes for the net to leave the bottom after the winch is released. These delays increase with depth at the beginning of tows (Table 7, Fig. 4), largely due to the slack present with extended warp lengths. A similar response is expected during retrieval but the average delay for the net leaving bottom does not appear to increase with depth (Fig. 4). BCS profiles from four tows (Fig. 5 - tows 12/26/32/61) show the net leaving bottom just as the winch released. The profile for tow 63 shows net contact with bottom before winch lockup. The times for winch lockup and first bottom contact are the same for tow 72, with only a minor delay upon retrieval. These anomalies between the winch times and the BCS times may be the result of poor synchronization between the GPS and the BCS device, or to imprecision in the recording of the winch lockup and retrieval times as these latter times were recorded manually. Only tow 51 lacks a BCS profile because one of the BCS devices was lost during that tow.

Tow 6 was an unusual case where the net snagged on the bottom 25 minutes after winch lockup and the tow was suspended. The skipper was able to free the gear and lifted it to approximately 730 m below the surface where inspection of the Scanmar sensor data indicated proper gear configuration. The tow was then resumed after reaching bottom a second time and fishing continued for another 41 minutes. This tow was initially accepted as a valid tow after the net was inspected on deck for damage, ensuring that the catch was not compromised by gear failure. Tow 6 was ultimately considered invalid based on the highly irregular manner in which the tow was completed and the consequent difficulty in deciding how long the tow was actually in contact with the bottom. Such tows should normally be repeated under similar circumstances.

Bottom contact profiles for most tows indicated consistent bottom contact during the tow. Numerous tows (e.g. tows 15/32/36/37/38/59/61/73) showed irregular contact based on the BCS trace, probably due to bouncing of the device. These tows were accepted as valid tows because they met the tow duration criteria which are based only on the net arrival and departure time from bottom. A quick review of the profiles in Figure 6 illustrates that bottom contact can be quite variable but the reasons for this variability are not well understood. Possible factors include substrate variation, rough topography, currents and others that influence fishing characteristics of trawl nets. The US National Marine Fisheries Service (NMFS) uses these BCS devices to determine the net arrival and liftoff times but does not use them to determine the precise period of net contact on the bottom (M. Wilkins, NMFS, pers. comm.).

## CATCHES AND CATCH RATES

The top six species by weight accounted for over 86% of the total catch weight from 66 valid survey tows (Table 8). The most abundant species by weight were sablefish, roughscale rattail, and longspine thornyheads. These three species represented 55% of the 24.1 tonnes caught during the survey.

Roughscale rattail (*Coryphaenoides acrolepis*) is also known as the Pacific grenadier, while the pectoral rattail (*Albatrossia pectoralis*) is also known as the giant grenadier. We will continue to refer to these two species as rattails rather than as grenadiers for consistency with earlier survey documents (Starr et al. 2002, Starr et al. 2004).

Longspine and shortspine thornyheads were each taken in 63 of 66 valid tows (96%) while sablefish (85%), pectoral rattail (92%) and roughscale rattail (77%) were well represented in most survey tows (Table 8). Pacific flatnose (*Antimora microlepis*), tanner crabs (*Chionoecetes* sp.), threadfin grenadier (*Coryphaenoides filifer*) and deepsea sole (*Embassichthys bathybius*) were often part of the catch but contributed less than 6% of the combined catch weight.

Inspected catches from another 8 tows that were not used for biomass analysis captured 45 species/groups, including three species (barracudinas, blacktail snailfish *Careproctus melanurus*, threadfin slickhead *Talismania bifurcata*) which were absent from the valid biomass tows (Table 9).

## BIOLOGICAL DATA

Four hundred thirty two samples were taken from the 66 valid survey tows to obtain biological data for 18 species, including length and sex data (Table 10). Of the 15,797 specimens processed, maturity information was collected from 12 species (11,487 fish). Twelve species had individual weights recorded (3,655 fish) and otoliths were collected from 11 species (3,656 fish). A further 12 samples were collected from rejected tows 6 and 35 (Table 11).

Sablefish tags were recovered from 13 fish (Table 12). Specimen data and tags were forwarded to Malcolm Wyeth (DFO, Pacific Biological Station, Nanaimo, B.C.) to assist with sablefish monitoring and assessment.

Summary unscaled length data for selected species are provided by depth zone in Table 13. Unscaled length frequency distributions for the 18 species (Figure 6) are provided for species which were subsampled for otolith and weight data. The random subsampling method used in 2003 appears to have been successful, given the good correspondence between the two

size distributions. Scaled length and weight frequencies by sex have not been calculated for this report.

Weight-length regressions for six species are shown in Figure 7. These relationships are consistent with equivalent relationships calculated from the previous two surveys (Starr et al. 2002, 2004).

## BIOMASS ESTIMATION

This survey is designed to: 1) estimate relative biomass for longspine thornyheads with no more than a 20% RE, and 2) explore the practicality of obtaining estimates from other groundfish species which exhibit sufficiently low RE values such that these biomass estimates could be used in a formal stock assessment. These survey estimates will allow the comparison of relative biomass changes across years. The complete series, spanning 2001 to 2003, will provide the basis for beginning a longer times series of biomass estimates for these species.

Relative biomass estimates from the 2003 survey are well below the 20% RE target set for longspine thornyhead and are also under 20% RE for another nine species (Table 14). Longspine thornyhead biomass is estimated at 4,971 t (11.2% RE) within the survey area off the west coast of Vancouver Island. Shortspine thornyhead biomass is approximately 2,500 t with a 13.2% RE. The two dominant rattail species have a combined biomass of just over 27,500 t and RE values between 15-20%. Biomass estimates for sablefish are similar in scale to those of longspine thornyheads. Figure 8 illustrates species biomass estimates based on bottom contact times and winch times for selected species.

Survey stratification by area and depth provide additional insight into species biomass distributions. Thornyhead and sablefish biomass estimates are summarized for each of the 21 survey strata in Table 15.

## COMPARISON WITH PREVIOUS SURVEY BIOMASS ESTIMATES

Two methodologies have been developed to compare the biomass estimates from this survey across years because of changes in the survey design. The following restrictions were used to provide comparability of the estimates for 2001-2003:

- Area G (Quatsino; Figure 1) was dropped as it was not surveyed in 2001.
- A constant wingspread of 20 m was used because wingspread measurements are not available for 2001.
- Tow duration based on the time from winch lockup to net retrieval (winch time) was used to calculate the CPUE density because the behaviour of the BCS device appeared to differ between the 2001 survey and the two subsequent surveys.

There are few differences in biomass by species between survey years after applying these restrictions and considering sampling variability. The thornyhead estimates are consistent and show low variability between years, while the sablefish and two sole estimates appear to be more variable (Table 16). Very few of the species show significant differences between survey years, although this is often due to the high relative errors for some species (e.g. longnose skate, brittle stars). The only significant differences between the three surveys are for Tanner crabs, which have a considerably lower biomass estimate for 2001, and for brittle stars. Squid relative

biomass appears to increase steadily with year but the differences remain non-significant due to estimation error.

A somewhat better comparison is possible for 2002-2003 due to greater similarities between these two surveys because the same vessel and skipper were used, similar net mensuration sensors are available and the same survey areas were covered. Unlike the 2001 survey, the two more recent surveys included area G (Quatsino) and thus cover the entire southern management area for longspine thornyheads.

Relative biomass estimates between the two years are similar for most species once sampling variability is considered (Table 17, Fig. 9). There is a possible decrease in the Pacific flatnose biomass between the two surveys. Deepsea sole biomass is also considerably lower in 2003 but the high RE values for these biomass estimates means that the difference is not significant. The largest biomass difference occurs for brittle stars but the high RE again suggests these two estimates are not statistically different.

## RECOMMENDATIONS

Several recommendations arise following the third consecutive year of this survey to assist with implementing future surveys:

- Measure and document detailed net dimensions and materials at the beginning of each survey to capture any possible changes in net configuration between surveys.
- The Scanmar depth sensor range should be adjusted at the factory to record depths beyond 1240 metres.
- Scanmar distance sensors should be available to record both wingspread and doorspread readings.
- Nobeltec tow track logging should cover the entire tow, beginning before winch lockup and continuing until after the net leaves the bottom following winch release.

## CONCLUSION

Three consecutive years of survey data have produced a valuable benchmark for future thornyhead assessments off the west coast of Vancouver Island. Schnute et al. (2004) have reviewed the available commercial and survey thornyhead data and have demonstrated the utility of these surveys for assessment of commercial species. Application of the design used in this survey to other areas of the BC coast is recommended by Schnute et al. (2004) on a rotating basis and is considered a high priority for the Rennell thornyhead management region off the west coast of the Queen Charlotte Islands.

## ACKNOWLEDGEMENTS

We appreciate the support and funding provided by the CGRCS, without which the survey would not have been possible. Dave Clattenberg and the crew of the F/V *Ocean Selector* worked effectively and efficiently with survey staff again this year. Experienced AMR staff Dean Gaidica and Mike Orcutt sampled long and hard to gather survey data. Nev Venables' help in the sampling arena was greatly appreciated after Paul Starr's departure. Devin Kellegrew from the BC office for Scanmar and Ernest Sorensen from Port Hardy thankfully resolved the data capture issues from the net sensors midway through the cruise. Scott Buchanan coordinated AMR staff participation and handled the preliminary data keypunching/proofing. Kate Rutherford and Norm Olsen ensured proper DFO archiving of the data.

## REFERENCES

Buchanan, S., and Orcutt, M. 2004. 2003 Areal stratified survey for longspine thornyheads - west coast of Vancouver Island. Archipelago Marine Research Ltd., Victoria, BC, Cruise Report. 52 p.

DFO. 2002. Operational guidelines for the 2002/2003 NORTHERN experimental fishery for Longspine Thornyheads (*Sebastolobus altivelis*). Fisheries & Oceans Canada. 10 p.

Cochran, W.G. 1977. Sampling techniques. 3rd Edition. John Wiley & Sons, New York. 413 p.

Quinn, T.R., and Deriso, R.B. 1999. Quantitative Fish Dynamics. Oxford University Press. 542 p.

Schnute, J.T., Boers, N.M., and Haigh, R. 2003. PBS software: maps, spatial analysis, and other utilities. Can. Tech. Rep. Fish. Aquat. Sci. 2496: 82 p.

Schnute, J., Haigh, R., Krishka, B., Sinclair, A., and Starr, P. 2004. The British Columbia longspine thornyhead fishery: analysis of survey and commercial data (1996-2003). Pacific Scientific Advice Review Committee. Can. Stock Assess. Secretariat Res. Doc. 2004/059: 75 p.

Schnute, J.T., Olsen, N., and Haigh, R. 1999. Slope rockfish assessment for the west coast of Canada in 1999. Can. Stock Assess. Secretariat Res. Doc 99/184: 104 p.

Starr, P.J., Krishka, B.A., and Choromanski, E M. 2002. Trawl survey for thornyhead biomass estimation off the west coast of Vancouver Island, September 15 to October 2, 2001. Can. Tech. Rep. Fish. Aquat. Sci. 2421: 60 p.

Starr, P.J., Krishka, B.A., and Choromanski, E.M. 2004. Longspine thornyhead random stratified trawl survey off the west coast of Vancouver Island, September 6-23, 2002. Can. Tech. Rep. Fish. Aquat. Sci.: 2558: v + 81 p.

Starr, P.J., and Schwarz, C. 2000. Feasibility of a bottom trawl survey for three slope groundfish species in Canadian waters. Can. Stock Assess. Secretariat Res. Doc 2000/156: 42 p.

**Table 1.** Names and labels for seven area strata and three depth zone strata used for the 2003 survey. Trawlable area ($km^2$) is the estimated area after the removal of untrawlable areas identified by Chris Roberts (skipper of the F/V *Viking Storm*) prior to the 2001 survey. Note that untrawlable areas in area G are not defined.

| Area | Name | Depth Zone (m) | Estimated Area ($km^2$) | |
|---|---|---|---|---|
| | | | Total | Trawlable |
| A | Barkley | 501-800 | 487 | 384 |
| | | 801-1200 | 702 | 637 |
| | | 1201-1600 | 577 | 577 |
| B | Loudon/Clayoquot | 501-800 | 330 | 233 |
| | | 801-1200 | 373 | 336 |
| | | 1201-1600 | 694 | 694 |
| C | Clayoquot/Estevan | 501-800 | 265 | 238 |
| | | 801-1200 | 380 | 380 |
| | | 1201-1600 | 462 | 462 |
| D | Nootka/500 | 501-800 | 274 | 154 |
| | | 801-1200 | 386 | 221 |
| | | 1201-1600 | 448 | 427 |
| E | Esperanza/Kyuquot | 501-800 | 427 | 324 |
| | | 801-1200 | 355 | 290 |
| | | 1201-1600 | 259 | 252 |
| F | Cape Cook/Winter Harbour | 501-800 | 201 | 79 |
| | | 801-1200 | 540 | 367 |
| | | 1201-1600 | 571 | 523 |
| G | Quatsino | 501-800 | 130 | 130 |
| | | 801-1200 | 215 | 215 |
| | | 1201-1600 | 307 | 307 |
| | **Total** | | **8,383** | **7,230** |

**Table 2.** Biological sampling targets for selected fish species. Specimen sampling designations include: LS (length/sex), LWSMO (length/weight/sex/maturity/otoliths), and LSM (length/sex/maturity). Samples are taken from each tow that captures listed species.

| Species | Specimen sampling | Type of Otolith sampling | Target number of otoliths for the survey | Otoliths to sample per tow |
|---|---|---|---|---|
| Longspine thornyhead | LS, LWSMO | Random | 1,000 | 20 |
| Shortspine thornyhead | LS, LWSMO | Random | 600 | 12 |
| Shortraker rockfish | LWSMO | Every fish | 200 | N/A |
| Rougheye rockfish | LWSMO | Every fish | 200 | N/A |
| Dover sole | LS, LWSMO | Random | 500 | 12 |
| Deepwater sole | LSM | No | N/A | N/A |
| Arrowtooth flounder | LS, LWSMO | Every fish | 200 | N/A |
| Sablefish | LS, LWSMO | Random | 500 | 12 |
| Roughscale rattail | LS | Random* | N/A | 6 |
| Pectoral rattail | LS | Random* | N/A | 6 |
| Sharks or skates | LS | No | N/A | N/A |

* undertaken if time permits

**Table 3.** Summary of stratum, time, distance, speed, and depth information for completed tows that were used for biomass estimation. The random sequence number (SEQ) refers to the order in which potential trawl sites were selected *within* each area/depth combination. Table contents are sorted by area, depth zone and then tow. Tow distance is estimated from bridge log interval data. Measures of tow duration and estimated distance include: a) the time from winch lockup to release (Winch) and b) the time span from first to last net contact with bottom based on bottom contact sensor (BCS) profiles (see Figure 6). Mean vessel speed is based on interval data from winch lockup to release.

| Tow | Area | Depth zone (m) | Date | Tow Duration (minutes) | | SEQ | Est. Distance (km) | | Vessel speed | Start Depth | End Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Winch | BCS | | Winch | BCS | (km/h) | (m) | (m) |
| 8 | A | 501-800 | Sept. 06, 2003 | 69 | 72 | 3 | 6.50 | 6.27 | 5.65 | 580 | 576 |
| 9 | A | 501-800 | Sept. 06, 2003 | 64 | 71 | 1 | 5.26 | 5.39 | 4.93 | 722 | 741 |
| 10 | A | 501-800 | Sept. 06, 2003 | 66 | 65 | 10 | 5.68 | 5.49 | 5.16 | 536 | 576 |
| 11 | A | 501-800 | Sept. 06, 2003 | 68 | 65 | 9 | 5.23 | 4.75 | 4.62 | 689 | 565 |
| 1 | A | 801-1200 | Sept. 05, 2003 | 62 | 63 | 2 | 4.33 | 4.15 | 4.19 | 997 | 1000 |
| 3 | A | 801-1200 | Sept. 05, 2003 | 63 | 58 | 3 | 4.68 | 4.25 | 4.45 | 951 | 786 |
| 5 | A | 801-1200 | Sept. 05, 2003 | 67 | 57 | 6 | 4.33 | 4.05 | 3.88 | 986 | 1035 |
| 2 | A | 1201-1600 | Sept. 05, 2003 | 67 | 61 | 2 | 4.80 | 4.17 | 4.30 | 1253 | 1242 |
| 7 | A | 1201-1600 | Sept. 06, 2003 | 74 | 64 | 5 | 5.38 | 4.67 | 4.33 | 1234 | 1383 |
| 15 | B | 501-800 | Sept. 07, 2003 | 73 | 71 | 3 | 5.74 | 5.56 | 4.72 | 587 | 732 |
| 16 | B | 501-800 | Sept. 07, 2003 | 74 | 76 | 2 | 6.32 | 6.34 | 5.13 | 560 | 552 |
| 17 | B | 501-800 | Sept. 08, 2003 | 63 | 61 | 4 | 4.76 | 4.62 | 4.53 | 633 | 640 |
| 21 | B | 501-800 | Sept. 08, 2003 | 63 | 59 | 5 | 5.37 | 5.02 | 5.11 | 732 | 691 |
| 14 | B | 801-1200 | Sept. 07, 2003 | 67 | 66 | 2 | 5.19 | 4.82 | 4.65 | 850 | 1006 |
| 18 | B | 801-1200 | Sept. 08, 2003 | 63 | 59 | 3 | 4.83 | 4.67 | 4.60 | 1024 | 896 |
| 19 | B | 801-1200 | Sept. 08, 2003 | 64 | 65 | 6 | 4.71 | 4.75 | 4.41 | 1072 | 969 |
| 20 | B | 801-1200 | Sept. 08, 2003 | 67 | 59 | 1 | 5.20 | 4.48 | 4.66 | 1170 | 1097 |
| 12 | B | 1201-1600 | Sept. 07, 2003 | 78 | 63 | 3 | 4.52 | 4.02 | 3.48 | 1417 | 1527 |
| 13 | B | 1201-1600 | Sept. 07, 2003 | 78 | 68 | 2 | 5.17 | 4.70 | 3.98 | 1262 | 1362 |
| 22 | C | 501-800 | Sept. 09, 2003 | 65 | 66 | 1 | 5.66 | 5.63 | 5.22 | 677 | 668 |
| 27 | C | 501-800 | Sept. 10, 2003 | 68 | 72 | 2 | 5.67 | 5.84 | 5.01 | 567 | 530 |
| 29 | C | 501-800 | Sept. 10, 2003 | 67 | 69 | 3 | 5.28 | 5.29 | 4.73 | 631 | 571 |
| 30 | C | 501-800 | Sept. 10, 2003 | 68 | 67 | 4 | 5.52 | 5.39 | 4.87 | 631 | 668 |
| 23 | C | 801-1200 | Sept. 09, 2003 | 66 | 71 | 2 | 5.30 | 5.43 | 4.82 | 881 | 860 |
| 24 | C | 801-1200 | Sept. 09, 2003 | 64 | 63 | 4 | 4.56 | 4.69 | 4.27 | 896 | 978 |
| 25 | C | 801-1200 | Sept. 09, 2003 | 69 | 65 | 3 | 5.16 | 4.95 | 4.49 | 1134 | 1112 |
| 28 | C | 801-1200 | Sept. 10, 2003 | 68 | 72 | 1 | 5.91 | 6.12 | 5.21 | 860 | 841 |
| 26 | C | 1201-1600 | Sept. 10, 2003 | 69 | 56 | 1 | 4.42 | 3.93 | 3.84 | 1289 | 1509 |
| 31 | C | 1201-1600 | Sept. 10, 2003 | 88 | 71 | 2 | 5.12 | 4.53 | 3.49 | 1454 | 1485 |
| 34 | D | 501-800 | Sept. 11, 2003 | 63 | 61 | 2 | 4.85 | 4.66 | 4.62 | 530 | 600 |
| 61 | D | 501-800 | Sept. 18, 2003 | 80 | 73 | 4 | 6.33 | 5.96 | 4.75 | 640 | 640 |
| 62 | D | 501-800 | Sept. 18, 2003 | 61 | 66 | 3 | 4.72 | 4.70 | 4.64 | 589 | 501 |
| 63 | D | 501-800 | Sept. 18, 2003 | 66 | 74 | 5 | 5.03 | 5.27 | 4.57 | 604 | 658 |
| 32 | D | 801-1200 | Sept. 10, 2003 | 85 | 69 | 4 | 5.94 | 5.12 | 4.20 | 1134 | 988 |
| 36 | D | 801-1200 | Sept. 11, 2003 | 68 | 70 | 3 | 5.04 | 4.90 | 4.45 | 812 | 799 |
| 59 | D | 801-1200 | Sept. 17, 2003 | 74 | 80 | 2 | 5.51 | 5.77 | 4.46 | 896 | 896 |
| 60 | D | 801-1200 | Sept. 17, 2003 | 62 | 57 | 1 | 4.49 | 4.15 | 4.35 | 988 | 1024 |
| 33 | D | 1201-1600 | Sept. 11, 2003 | 74 | 65 | 1 | 4.55 | 4.24 | 3.69 | 1298 | 1390 |
| 58 | D | 1201-1600 | Sept. 16, 2003 | 55 | 43 | 2 | 3.93 | 3.08 | 4.29 | 1298 | 1262 |

(Continued)

**Table 3** (continued).

| Tow | Area | Depth zone (m) | Date | Duration (minutes) | | SEQ | Distance (km) | | Vessel speed (km/h) | Start Depth (m) | End Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Winch | BCS | | Winch | BCS | | | |
| 53 | E | 501-800 | Sept. 15, 2003 | 58 | 54 | 3 | 5.14 | 4.76 | 5.31 | 594 | 604 |
| 71 | E | 501-800 | Sept. 19, 2003 | 68 | 66 | 5 | 6.58 | 6.10 | 5.81 | 613 | 594 |
| 72 | E | 501-800 | Sept. 20, 2003 | 55 | 56 | 9 | 4.88 | 4.94 | 5.32 | 713 | 677 |
| 74 | E | 501-800 | Sept. 20, 2003 | 58 | 56 | 8 | 4.58 | 4.33 | 4.74 | 631 | 783 |
| 54 | E | 801-1200 | Sept. 15, 2003 | 60 | 60 | 2 | 4.71 | 4.62 | 4.71 | 924 | 841 |
| 65 | E | 801-1200 | Sept. 18, 2003 | 71 | 74 | 3 | 5.50 | 5.60 | 4.65 | 933 | 924 |
| 66 | E | 801-1200 | Sept. 19, 2003 | 70 | 746 | 5 | 5.20 | 5.32 | 4.46 | 997 | 988 |
| 67 | E | 801-1200 | Sept. 19, 2003 | 74 | 76 | 7 | 5.62 | 5.70 | 4.56 | 1097 | 878 |
| 68 | E | 1201-1600 | Sept. 19, 2003 | 66 | 59 | 34 | 4.53 | 4.07 | 4.12 | 1280 | 1244 |
| 70 | E | 1201-1600 | Sept. 19, 2003 | 82 | 64 | 41 | 5.28 | 4.23 | 3.86 | 1317 | 1289 |
| 51 | F | 501-800 | Sept. 15, 2003 | 71 | 71 | 5 | 5.60 | 5.60 | 4.43 | 604 | 786 |
| 52 | F | 501-800 | Sept. 15, 2003 | 60 | 56 | 3 | 4.94 | 4.41 | 4.94 | 549 | 530 |
| 55 | F | 501-800 | Sept. 16, 2003 | 43 | 39 | 15 | 3.56 | 3.14 | 4.97 | 549 | 494 |
| 56 | F | 501-800 | Sept. 16, 2003 | 50 | 50 | 22 | 3.71 | 3.58 | 4.45 | 516 | 521 |
| 73 | F | 501-800 | Sept. 20, 2003 | 43 | 49 | 44 | 3.32 | 3.91 | 4.64 | 594 | 549 |
| 42 | F | 801-1200 | Sept. 13, 2003 | 59 | 60 | 1 | 4.47 | 4.38 | 4.54 | 860 | 1006 |
| 43 | F | 801-1200 | Sept. 14, 2003 | 54 | 57 | 2 | 3.61 | 3.80 | 4.01 | 1079 | 1125 |
| 44 | F | 801-1200 | Sept. 14, 2003 | 51 | 55 | 6 | 3.79 | 3.92 | 4.46 | 1070 | 1061 |
| 49 | F | 801-1200 | Sept. 15, 2003 | 51 | 48 | 4 | 3.97 | 3.79 | 4.66 | 863 | 1061 |
| 46 | F | 1201-1600 | Sept. 14, 2003 | 57 | 51 | 3 | 3.40 | 3.19 | 3.58 | 1372 | 1317 |
| 50 | F | 1201-1600 | Sept. 15, 2003 | 62 | 49 | 1 | 4.49 | 3.50 | 4.35 | 1335 | 1308 |
| 37 | G | 501-800 | Sept. 12, 2003 | 58 | 57 | 2 | 4.79 | 4.64 | 4.95 | 549 | 523 |
| 38 | G | 501-800 | Sept. 12, 2003 | 56 | 52 | 5 | 4.73 | 4.46 | 5.06 | 604 | 604 |
| 40 | G | 801-1200 | Sept. 13, 2003 | 52 | 58 | 13 | 4.09 | 4.19 | 4.71 | 969 | 1198 |
| 41 | G | 801-1200 | Sept. 13, 2003 | 54 | 52 | 10 | 4.15 | 3.65 | 4.61 | 1097 | 951 |
| 47 | G | 1201-1600 | Sept. 14, 2003 | 67 | 60 | 1 | 4.38 | 4.02 | 3.92 | 1244 | 1253 |
| 48 | G | 1201-1600 | Sept. 14, 2003 | 53 | 53 | 22 | 3.33 | 3.32 | 3.77 | 1262 | 1280 |

**Table 4.** Tows that were attempted and excluded from analyses and the reasons why.

| Tow | Area | Depth Zone (m) | Date | Reason for exclusion |
|---|---|---|---|---|
| 4 | A | 801-1200 | Sept. 5, 2003 | Tow aborted – communications line hooked |
| 6 | A | 801-1200 | Sept. 5, 2003 | Tow rejected – snagged on bottom |
| 35 | D | 801-1200 | Sept. 11, 2003 | Tow aborted – snagged on bottom |
| 39 | G | 801-1200 | Sept. 12, 2003 | Tow rejected – wing was twisted |
| 45 | F | 1201-1600 | Sept. 14, 2003 | Tow aborted – twisted wing |
| 57 | E | 801-1200 | Sept. 16, 2003 | Tow aborted – twisted wing |
| 64 | E | 801-1200 | Sept. 18, 2003 | Tow aborted – twisted wing |
| 69 | E | 1201-1600 | Sept. 19, 2003 | Tow aborted – depth dropped below stratum maximum |

**Table 5.** Reasons for rejecting selected tow sites following exploratory sounding by the skipper.

| Stratum | Reason | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | Wrong depth | Wrong Area | Bottom steep or irregular | Bottom too hard | Tow path too short | Too close to existing tows | |
| A1 | 3 | 2 | | | | 1 | 6 |
| A2 | 2 | | | | | | 2 |
| A3 | 3 | | 2 | | | | 5 |
| B1 | 1 | | | | | | 1 |
| B2 | 1 | | 1 | | | | 2 |
| B3 | | | | 1 | | | 1 |
| D1 | 1 | | | | | | 1 |
| E1 | 3 | | 2 | | | | 5 |
| E2 | 2 | | 1 | | | | 3 |
| E3 | 7 | | 16 | 2 | 1 | | 26 |
| F1 | 10 | | 6 | 4 | | 1 | 21 |
| F2 | 1 | | 1 | | | | 2 |
| F3 | | | 1 | | | | 1 |
| G1 | | 2 | 1 | | | | 3 |
| G2 | 2 | 4 | 5 | | | | 11 |
| G3 | | 7 | 13 | | | | 20 |
| **Total** | **36** | **15** | **49** | **7** | **1** | **2** | **110** |

**Table 6.** Summary statistics of selected gear and tow characteristics by depth strata. Only valid biomass tows are considered. Winch time refers to the time from winch lockup to winch release. Bottom contact time is the time span from first-to-last bottom contact based on bottom contact sensor data. Tow distance from Nobeltec navigational software is automatically calculated from tow track data.

| | Mean | Minimum | Maximum | N | Standard Deviation |
|---|---|---|---|---|---|
| ***Estimates based on winch time*** | | | | | |
| **Tow distance (km)** | | | | | |
| 501-800 m | 5.18 | 3.32 | 6.58 | 27 | 0.82 |
| 801-1200 m | 4.81 | 3.61 | 5.94 | 25 | 0.64 |
| 1201-1600 m | 4.52 | 3.33 | 5.34 | 14 | 0.63 |
| **All tows** | **4.90** | **3.32** | **6.58** | **66** | **0.75** |
| **Doorspread (m)** | | | | | |
| 501-800 m | 59.73 | 52.12 | 64.31 | 27 | 2.59 |
| 801-1200 m | 58.25 | 49.56 | 61.38 | 25 | 3.02 |
| 1201-1600 m | 59.42 | 52.10 | 63.13 | 14 | 3.47 |
| **All tows** | **59.10** | **49.56** | **64.31** | **66** | **2.99** |
| **Wingspread (m)** | | | | | |
| 501-800 m | 17.42 | 16.21 | 18.08 | 27 | 0.40 |
| 801-1200 m | 17.20 | 15.76 | 17.68 | 25 | 0.48 |
| 1201-1600 m | 17.37 | 16.21 | 17.92 | 14 | 0.54 |
| **All tows** | **17.33** | **15.76** | **18.08** | **66** | **0.47** |
| **Opening (m)** | | | | | |
| 501-800 m | 3.19 | 2.76 | 4.44 | 27 | 0.39 |
| 801-1200 m | 3.39 | 2.98 | 4.08 | 25 | 0.30 |
| 1201-1600 m | 3.70 | 2.62 | 5.11 | 14 | 0.57 |
| **All tows** | **3.37** | **2.62** | **5.11** | **66** | **0.44** |
| **Vessel speed (km/h)** | | | | | |
| 501-800 m | 4.94 | 4.45 | 5.81 | 27 | 0.33 |
| 801-1200 m | 4.50 | 3.88 | 5.21 | 25 | 0.27 |
| 1201-1600 m | 3.93 | 3.48 | 4.35 | 14 | 0.31 |
| **All tows** | **4.56** | **3.48** | **5.81** | **66** | **0.49** |
| ***Estimates based on bottom contact time*** | | | | | |
| **Tow distance (km)** | | | | | |
| 501-800 m | 5.03 | 3.14 | 6.34 | 27 | 0.79 |
| 801-1200 m | 4.69 | 3.65 | 6.12 | 25 | 0.68 |
| 1201-1600 m | 3.98 | 3.08 | 4.70 | 14 | 0.53 |
| **All tows** | **4.68** | **3.08** | **6.34** | **66** | **0.80** |
| **Vessel speed (km/h)** | | | | | |
| 501-800 m | 4.84 | 4.28 | 5.59 | 27 | 0.33 |
| 801-1200 m | 4.44 | 3.96 | 5.13 | 25 | 0.24 |
| 1201-1600 m | 4.06 | 3.79 | 4.42 | 14 | 0.22 |
| **All tows** | **4.52** | **3.79** | **5.59** | **66** | **0.40** |
| ***Estimates from Nobeltec*** | | | | | |
| **Tow distance (km)** | | | | | |
| 501-800 m | 5.18 | 0.81 | 6.68 | 27 | 0.79 |
| 801-1200 m | 4.82 | 0.63 | 5.94 | 25 | 0.68 |
| 1201-1600 m | 4.45 | 0.61 | 5.30 | 14 | 0.53 |
| **All tows** | **4.89** | **3.32** | **0.75** | **66** | **0.80** |

**Table 7.** Time delays in minutes for: a) first gear contact with bottom following winch lockup, and b) last gear contact with bottom after winch release for net retrieval. Initial and final gear contact times are determined from bottom contact sensor data for valid tows only.

| Depth Zone | Mean | Standard Deviation | Minimum | Maximum | N |
|---|---|---|---|---|---|
| **Winch lockup to first bottom contact** (minutes) | | | | | |
| 501-800 m | 5.2 | 2.4 | -0.4 | 10.5 | 26 |
| 801-1200 m | 8.5 | 3.5 | 2.9 | 16.1 | 25 |
| 1201-1600 m | 15.1 | 3.2 | 9.2 | 22.8 | 14 |
| **All tows** | **8.6** | **4.8** | **-0.4** | **22.8** | **65** |
| **Winch release to last bottom contact** (minutes) | | | | | |
| 501-800 m | 4.9 | 2.7 | 0.5 | 10.0 | 26 |
| 801-1200 m | 7.6 | 2.8 | 0.0 | 12.2 | 25 |
| 1201-1600 m | 4.6 | 2.6 | 0.3 | 8.8 | 14 |
| **All tows** | **5.9** | **3.0** | **0.0** | **12.2** | **65** |

**Table 8.** Species or higher taxonomic groups captured in 66 valid tows during the 2003 survey. Species catches are listed in descending order of total catch. Species codes come from the DFO GFBio database. Appendix E lists species and catch weights for each of the 66 valid tows plus eight tows that were either rejected or aborted.

| Species | Scientific Name | GFBio Species code | Catch Weight (kg) | Valid tows | % of valid tows | % of total catch | Cumulative % of total catch |
|---|---|---|---|---|---|---|---|
| Sablefish | *Anoplopoma fimbria* | 455 | 5,506.89 | 57 | 85.1 | 22.7 | 22.7 |
| Roughscale rattail | *Coryphaenoides acrolepis* | 251 | 4,379.41 | 51 | 77.3 | 18.1 | 41.0 |
| Longspine thornyhead | *Sebastolobus altivelis* | 453 | 3,401.64 | 63 | 95.5 | 14.1 | 55.1 |
| Shortspine thornyhead | *Sebastolobus alascanus* | 451 | 2,997.82 | 63 | 95.5 | 12.4 | 67.5 |
| Pectoral rattail | *Albatrossia pectoralis* | 256 | 2,265.30 | 61 | 92.4 | 9.4 | 76.9 |
| Dover sole | *Microstomus pacificus* | 626 | 2,255.66 | 39 | 59.1 | 9.3 | 86.2 |
| Shortraker rockfish | *Sebastes borealis* | 403 | 467.59 | 19 | 28.8 | 1.9 | 88.2 |
| Schoolmaster gonate squid | *Berryteuthis magister* | 95E | 382.38 | 47 | 71.2 | 1.6 | 89.7 |
| Pacific flatnose | *Antimora microlepis* | 220 | 381.11 | 64 | 97.0 | 1.6 | 91.3 |
| Tanner crabs | *Chionoecetes* | ZAD | 345.27 | 56 | 84.8 | 1.4 | 92.8 |
| Longnose skate | *Raja rhina* | 059 | 234.69 | 17 | 25.8 | 1.0 | 93.7 |
| Pacific hake | *Merluccius productus* | 225 | 204.67 | 27 | 40.9 | 0.8 | 94.6 |
| Threadfin grenadier | *Coryphaenoides filifer* | 254 | 142.69 | 51 | 77.3 | 0.6 | 95.2 |
| Popeye | *Coryphaenoides cinereus* | 250 | 136.00 | 24 | 36.4 | 0.6 | 95.7 |
| Arrowtooth flounder | *Atheresthes stomias* | 602 | 132.82 | 11 | 16.7 | 0.6 | 96.3 |
| Deepsea sole | *Embassichthys bathybius* | 605 | 108.79 | 44 | 66.7 | 0.5 | 96.7 |
| Abyssal skate | *Bathyraja abyssicola* | 054 | 104.66 | 13 | 19.7 | 0.4 | 97.2 |
| Roughtail skate | *Bathyraja trachura* | 057 | 67.59 | 14 | 21.2 | 0.3 | 97.4 |
| Slickheads | Alepocephalidae | 642 | 61.58 | 21 | 31.8 | 0.3 | 97.7 |
| Twoline eelpout | *Bothrocara brunneum* | 235 | 53.60 | 36 | 54.5 | 0.2 | 97.9 |
| Anemone | Actiniaria | 3L0 | 46.97 | 30 | 45.5 | 0.2 | 98.1 |
| Inanimate objects | | 004 | 40.16 | 16 | 24.2 | 0.2 | 98.3 |
| Rex sole | *Glyptocephalus zachirus* | 610 | 35.65 | 9 | 13.6 | 0.1 | 98.4 |
| Pacific sleeper shark | *Somniosus pacificus* | 043 | 34.75 | 2 | 3.0 | 0.1 | 98.6 |
| Rougheye rockfish | *Sebastes aleutianus* | 394 | 33.24 | 9 | 13.6 | 0.1 | 98.7 |
| Glass sponges | Hexactinellida | 2I0 | 32.00 | 16 | 24.2 | 0.1 | 98.8 |
| Black eelpout | *Lycodes diapterus* | 243 | 26.63 | 24 | 36.4 | 0.1 | 99.0 |
| Giant squid | *Architeuthis martensi* | 92R | 25.39 | 1 | 1.5 | 0.1 | 99.1 |
| Vampire squid | Vampyromorpha | 96E | 24.33 | 11 | 16.7 | 0.1 | 99.2 |
| Zoantharia | Zoantharia | 3J1 | 22.30 | 9 | 13.6 | 0.1 | 99.3 |
| Brown cat shark | *Apristurus brunneus* | 038 | 18.90 | 20 | 30.3 | 0.1 | 99.3 |
| Sandpaper skate | *Bathyraja interrupta* | 058 | 18.84 | 10 | 15.2 | 0.1 | 99.4 |
| Octopus | *Octopus* sp. | 98D | 16.10 | 11 | 16.7 | 0.1 | 99.5 |
| Octopus | Octopoda | 97A | 11.97 | 3 | 4.5 | 0.0 | 99.5 |
| Echinasteridae | Echinasteridae | 4QA | 9.67 | 8 | 12.1 | 0.0 | 99.6 |
| Giant blobsculpin | *Psychrolutes phrictus* | 534 | 9.52 | 2 | 3.0 | 0.0 | 99.6 |
| Solasteridae | Solasteridae | 4TA | 9.06 | 31 | 47.0 | 0.0 | 99.6 |
| Sponges | Porifera | 2A0 | 8.88 | 12 | 18.2 | 0.0 | 99.7 |
| Squids | Teuthoidea | 92A | 8.65 | 3 | 4.5 | 0.0 | 99.7 |
| Spiny red sea star | *Hippasteria spinosa* | 4JF | 7.19 | 19 | 28.8 | 0.0 | 99.7 |
| Bigfin eelpout | *Lycodes cortezianus* | 233 | 6.29 | 10 | 15.2 | 0.0 | 99.8 |
| Blacktail snailfish | *Careproctus melanurus* | 574 | 4.64 | 20 | 30.3 | 0.0 | 99.8 |
| Lithodes couesi | *Lithodes couesi* | VMD | 4.38 | 8 | 12.1 | 0.0 | 99.8 |
| Gorgonian corals | Gorgonacea | 3S0 | 3.24 | 3 | 4.5 | 0.0 | 99.8 |
| Pacific hagfish | *Eptatretus stouti* | 018 | 3.20 | 8 | 12.1 | 0.0 | 99.8 |
| Brittle stars | Phrynophiurida | 5AB | 3.18 | 16 | 24.2 | 0.0 | 99.9 |

(Continued)

**Table 8** (continued).

| Species | Scientific Name | GFBio Species code | Catch Weight (kg) | Valid tows | % of valid tows | % of total catch | Cumulative % of total catch |
|---|---|---|---|---|---|---|---|
| Lumpfishes and Snailfishes | Cyclopteridae | 568 | 2.91 | 10 | 15.2 | 0.0 | 99.9 |
| Lithodes | *Lithodes* sp. | VMB | 2.73 | 2 | 3.0 | 0.0 | 99.9 |
| Deepsea smelts | Bathylagidae | 152 | 2.65 | 25 | 37.9 | 0.0 | 99.9 |
| Aurora rockfish | *Sebastes aurora* | 400 | 2.56 | 4 | 6.1 | 0.0 | 99.9 |
| Lithodinae | Lithodinae | VLA | 2.51 | 1 | 1.5 | 0.0 | 99.9 |
| Jellyfish | Scyphozoa | 3G0 | 1.98 | 11 | 16.7 | 0.0 | 99.9 |
| Sea cucumber | Holothuroidea | 6NA | 1.89 | 9 | 13.6 | 0.0 | 99.9 |
| Paragorgia pacifica | *Paragorgia pacifica* | 3S7 | 1.89 | 1 | 1.5 | 0.0 | 99.9 |
| Pacific ocean perch | *Sebastes alutus* | 396 | 1.80 | 1 | 1.5 | 0.0 | 99.9 |
| Basket stars | Euryalae | 5QA | 1.63 | 2 | 3.0 | 0.0 | 99.9 |
| Viperfishes | Chauliodontidae | 170 | 1.35 | 14 | 21.2 | 0.0 | 100.0 |
| Sand star | *Luidia foliolata* | 4GD | 1.35 | 10 | 15.2 | 0.0 | 100.0 |
| Eelpouts | Zoarcidae | 231 | 1.26 | 2 | 3.0 | 0.0 | 100.0 |
| Fish-eating star | *Stylasterias forreri* | 4XF | 1.15 | 9 | 13.6 | 0.0 | 100.0 |
| Shrimp | *Nantantia* sp. | SAB | 0.92 | 8 | 12.1 | 0.0 | 100.0 |
| Red king crab | *Paralithodes cammtschatica* | VNH | 0.90 | 3 | 4.5 | 0.0 | 100.0 |
| Redbanded rockfish | *Sebastes babcocki* | 401 | 0.90 | 1 | 1.5 | 0.0 | 100.0 |
| Northern lampfish | *Stenobrachius leucopsarus* | 198 | 0.81 | 19 | 28.8 | 0.0 | 100.0 |
| Slender codling | *Halargyreus johnsoni* | 223 | 0.59 | 1 | 1.5 | 0.0 | 100.0 |
| Splitnose rockfish | *Sebastes diploproa* | 412 | 0.52 | 2 | 3.0 | 0.0 | 100.0 |
| Henricia asthenactis | *Henricia asthenactis* | 4QD | 0.51 | 2 | 3.0 | 0.0 | 100.0 |
| Primnoa | *Primnoa* sp. | 3T0 | 0.42 | 3 | 4.5 | 0.0 | 100.0 |
| Lanternfishes | Myctophidae | 185 | 0.33 | 10 | 15.2 | 0.0 | 100.0 |
| Fish Eggs | | 001 | 0.28 | 4 | 6.1 | 0.0 | 100.0 |
| Lampreys | Petromyzontidae | 019 | 0.26 | 1 | 1.5 | 0.0 | 100.0 |
| Eualus | *Eualus* | SQA | 0.26 | 1 | 1.5 | 0.0 | 100.0 |
| Pinpoint lampfish | *Nannobrachium regale* | 191 | 0.20 | 2 | 3.0 | 0.0 | 100.0 |
| Heart urchins | Atelostomata | 6KA | 0.17 | 2 | 3.0 | 0.0 | 100.0 |
| Gastropods | Gastropoda | 10A | 0.14 | 10 | 15.2 | 0.0 | 100.0 |
| Bigeye poacher | *Bathyagonus pentacanthus* | 556 | 0.10 | 4 | 6.1 | 0.0 | 100.0 |
| Tarsaster alascanus | *Tarsaster alascanus* | 4YC | 0.10 | 1 | 1.5 | 0.0 | 100.0 |
| Sea urchins | Echinacea | 6AB | 0.10 | 1 | 1.5 | 0.0 | 100.0 |
| Sea whip | *Osteocella septentrionalis* | 3U2 | 0.10 | 3 | 4.5 | 0.0 | 100.0 |
| Slender blacksmelt | *Bathylagus pacificus* | 155 | 0.10 | 3 | 4.5 | 0.0 | 100.0 |
| True crabs | Bracyura | WAA | 0.06 | 1 | 1.5 | 0.0 | 100.0 |
| Blackfin poacher | *Bathyagonus nigripinnis* | 557 | 0.05 | 3 | 4.5 | 0.0 | 100.0 |
| Squat lobster | *Munida quadrispina* | VSA | 0.01 | 2 | 3.0 | 0.0 | 100.0 |
| Crested bigscale | *Poromitra crassiceps* | 264 | 0.01 | 4 | 6.1 | 0.0 | 100.0 |
| Snailfishes | Liparinae | 578 | Trace | 1 | 1.5 | 0.0 | 100.0 |
| Seaslugs | Nudibranchiata | 51A | Trace | 4 | 6.1 | 0.0 | 100.0 |
| Cushion star | *Pteraster tesselatus* | 4UH | Trace | 1 | 1.5 | 0.0 | 100.0 |
| Myxoderma sacculatum | *Myxoderma sacculatum* | 4YX | Trace | 4 | 6.1 | 0.0 | 100.0 |
| Polychaete worms | Polychaeta | 0AB | Trace | 1 | 1.5 | 0.0 | 100.0 |
| Pacific lyre crab | *Hyas lyratus* | ZBA | Trace | 1 | 1.5 | 0.0 | 100.0 |
| Unidentified organic matter | | 849 | Trace | 2 | 3.0 | 0.0 | 100.0 |
| Unknown fish | | 015 | Trace | 1 | 1.5 | 0.0 | 100.0 |
| Golden king crab | *Lithodes aequispina* | VMC | Trace | 1 | 1.5 | 0.0 | 100.0 |
| Psolidae | Psolidae | 6QA | Trace | 2 | 3.0 | 0.0 | 100.0 |
| **TOTAL** | | | **24,130.79** | **66** | | | |

**Table 9.** Species and higher taxonomic groups collected from eight rejected tows. Valid tows did not capture three of the 45 groups (shown in bold).

| Species | Scientific Name | GFBio Species Code | Total Catch (kg) | Number of Rejected Tows |
|---|---|---|---|---|
| Sablefish | *Anoplopoma fimbria* | 455 | 248.32 | 5 |
| Longspine thornyhead | *Sebastolobus altivelis* | 453 | 177.44 | 5 |
| Dover sole | *Microstomus pacificus* | 626 | 112.74 | 3 |
| Roughscale rattail | *Coryphaenoides acrolepis* | 251 | 52.40 | 4 |
| Shortspine thornyhead | *Sebastolobus alascanus* | 451 | 48.63 | 4 |
| Shortraker rockfish | *Sebastes borealis* | 403 | 36.17 | 2 |
| Pectoral rattail | *Albatrossia pectoralis* | 256 | 27.67 | 5 |
| Tanner crabs | *Chionoecetes* sp. | ZAD | 18.93 | 4 |
| Deepsea sole | *Embassichthys bathybius* | 605 | 11.94 | 4 |
| Schoolmaster gonate squid | *Berryteuthis magister* | 95E | 9.46 | 4 |
| Longnose skate | *Raja rhina* | 059 | 5.66 | 1 |
| Roughtail skate | *Bathyraja trachura* | 057 | 7.16 | 1 |
| Pacific hake | *Merluccius productus* | 225 | 5.56 | 2 |
| Abyssal skate | *Bathyraja abyssicola* | 054 | 5.26 | 1 |
| Sponges | Porifera | 2A0 | 3.43 | 3 |
| Threadfin grenadier | *Coryphaenoides filifer* | 254 | 2.18 | 2 |
| Slickheads | Alepocephalidae | 642 | 2.15 | 3 |
| Twoline eelpout | *Bothrocara brunneum* | 235 | 2.02 | 4 |
| Solasteridae | Solasteridae | 4TA | 1.99 | 2 |
| Octopus | Octopoda | 97A | 1.48 | 2 |
| Pacific hagfish | *Eptatretus stouti* | 018 | 1.29 | 2 |
| Pacific flatnose | *Antimora microlepis* | 220 | 1.13 | 2 |
| Popeye | *Coryphaenoides cinereus* | 250 | 0.82 | 2 |
| *Lithodes couesi* | *Lithodes couesi* | VMD | 0.80 | 1 |
| Bigfin eelpout | *Lycodes cortezianus* | 233 | 0.80 | 1 |
| **Barracudinas** | **Paralepididae** | 180 | 0.74 | 1 |
| Vampire squid | Vampyromorpha | 96E | 0.73 | 1 |
| Black eelpout | *Lycodes diapterus* | 243 | 0.72 | 2 |
| Brown cat shark | *Apristurus brunneus* | 038 | 0.62 | 1 |
| **Blacktail snailfish** | ***Careproctus melanurus*** | 574 | 0.47 | 1 |
| Spiny red sea star | *Hippasteria spinosa* | 4JF | 0.36 | 2 |
| Inanimate objects | | 004 | 0.36 | 1 |
| Brittle stars | Phrynophiurida | 5AB | 0.34 | 1 |
| Sandpaper skate | *Bathyraja interrupta* | 058 | 0.24 | 1 |
| Sea cucumber | Holothuroidea | 6NA | 0.17 | 1 |
| Blackfin poacher | *Bathyagonus nigripinnis* | 557 | Trace | 1 |
| Anemone | Actiniaria | 3L0 | Trace | 1 |
| **Threadfin slickhead** | ***Talismania bifurcata*** | 643 | Trace | 1 |
| Glass sponges | Hexactinellida | 2I0 | Trace | 1 |
| Zoantharia | Zoantharia | 3J1 | Trace | 1 |
| Jellyfish | Scyphozoa | 3G0 | Trace | 1 |
| Lanternfishes | Myctophidae | 185 | Trace | 1 |
| Lumpfishes and Snailfishes | Cyclopteridae | 568 | Trace | 1 |
| *Paragorgia pacifica* | *Paragorgia pacifica* | 3S7 | Trace | 1 |
| Gastropods | Gastropoda | 10A | Trace | 1 |
| **TOTAL** | | | **793.40** | **8** |

**Table 10.** Number of samples collected by species from 66 valid tows, plus numbers of specimens sampled for selected biological attributes. Otolith numbers refer to pairs of otoliths.

| Species | Species Code | Samples | Attribute | | | | |
|---|---|---|---|---|---|---|---|
| | | | Length | Weight | Sex | Maturity | Otoliths |
| Longspine thornyhead | 453 | 63 | 5,014 | 1,233 | 5,008 | 3,923 | 1,233 |
| Shortspine thornyhead | 451 | 63 | 2,791 | 688 | 2,794 | 2,761 | 691 |
| Roughscale rattail | 251 | 39 | 2,361 | 220 | 2,362 | 327 | 220 |
| Dover sole | 626 | 38 | 1,977 | 418 | 1,980 | 1,979 | 419 |
| Sablefish | 455 | 56 | 1,883 | 586 | 1,883 | 1,868 | 587 |
| Pectoral rattail | 256 | 48 | 1,284 | 265 | 1,284 | 272 | 265 |
| Shortraker rockfish | 403 | 18 | 126 | 126 | 126 | 126 | 126 |
| Deepsea sole | 605 | 25 | 124 | 0 | 124 | 117 | 0 |
| Arrowtooth flounder | 602 | 11 | 83 | 83 | 83 | 83 | 83 |
| Roughtail skate | 057 | 12 | 34 | 0 | 34 | 0 | 0 |
| Longnose skate | 059 | 16 | 33 | 0 | 33 | 0 | 0 |
| Rougheye rockfish | 394 | 9 | 26 | 26 | 26 | 26 | 26 |
| Brown cat shark | 038 | 6 | 26 | 0 | 26 | 0 | 0 |
| Abyssal skate | 054 | 12 | 16 | 4 | 16 | 0 | 0 |
| Sandpaper skate | 058 | 9 | 10 | 0 | 10 | 0 | 0 |
| Aurora rockfish | 400 | 4 | 4 | 4 | 3 | 3 | 4 |
| Pacific sleeper shark | 043 | 2 | 3 | 0 | 3 | 0 | 0 |
| Redbanded rockfish | 401 | 1 | 2 | 2 | 2 | 2 | 2 |
| **Total** | | **432** | **15,797** | **3,655** | **15,797** | **11,487** | **3,656** |

**Table 11.** Additional samples collected from tows 6 and 35 that were rejected after becoming snagged on bottom. These samples are excluded from biomass analyses.

| Species | Species Code | Samples | Attribute | | | | |
|---|---|---|---|---|---|---|---|
| | | | Length | Weight | Sex | Maturity | Otolith |
| Longspine thornyhead | 453 | 2 | 170 | 40 | 170 | 83 | 40 |
| Roughscale rattail | 251 | 1 | 58 | 6 | 58 | 6 | 6 |
| Sablefish | 455 | 2 | 16 | 16 | 16 | 16 | 16 |
| Shortspine thornyhead | 451 | 2 | 14 | 14 | 14 | 14 | 14 |
| Deepsea sole | 605 | 1 | 12 | 0 | 12 | 12 | 0 |
| Dover sole | 626 | 1 | 11 | 11 | 11 | 11 | 11 |
| Pectoral rattail | 256 | 1 | 8 | 8 | 8 | 8 | 8 |
| Longnose skate | 059 | 1 | 2 | 0 | 2 | 0 | 0 |
| Shortraker rockfish | 403 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Total** | | 12 | 292 | 96 | 292 | 151 | 96 |

**Table 12.** Sablefish tags recovered during the 2003 survey.

| Tow | Position | | Date | Tag Number | Length (mm) | Weight (kg) |
|---|---|---|---|---|---|---|
| | Latitude | Longitude | | | | |
| 8 | 48° 25.014' | 126° 12.291' | Sept. 06/2003 | B8320263 | 543 | 1.84 |
| 10 | 48° 28.157' | 126° 12.887' | Sept. 06/2003 | B9723072 | 422 | 2.03 |
| 11 | 48° 32.525' | 126° 18.015' | Sept. 06/2003 | A00785637 | 669 | 3.70 |
| 28 | 49° 07.422' | 127° 03.927' | Sept. 19/2003 | B9937633 | 609 | 2.62 |
| 29 | 49° 12.384' | 127° 06.873' | Sept. 10/2003 | B9651106 | 566 | 2.28 |
| 30 | 49° 10.798' | 127° 05.891' | Sept. 10/2003 | A00043884 | 519 | 1.65 |
| 30 | 49° 10.798' | 127° 05.891' | Sept. 10/2003 | A00043899 | 543 | 1.73 |
| 40 | 50° 19.149' | 128° 22.361' | Sept. 13/2003 | CSA 23520 | 650 | 2.56 |
| 40 | 50° 19.149' | 128° 22.361' | Sept. 13/2003 | B9628560 | 533 | 1.42 |
| 42 | 50° 15.782' | 128° 21.968' | Sept. 13/2003 | B9937874 | - | - |
| 44 | 50° 10.961' | 128° 24.668' | Sept. 14/2003 | A00550526 | 606 | 2.24 |
| 62 | 49° 39.693' | 127° 27.266' | Sept. 18/2003 | B8365447 | 799 | 5.68 |
| 63 | 49° 38.357' | 127° 25.965' | Sept. 18/2003 | B9643074 | 735 | 4.82 |

**Table 13.** Unscaled length statistics and sample frequency by depth zone for the 66 valid tows.

| Species | Depth Zone (m) | Samples | Specimen length (mm) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Mean | SD | Min | Max | N |
| Longspine thornyhead | 501-800 | 24 | 204.8 | 44.1 | 71 | 313 | 1,811 |
| | 801-1200 | 26 | 207.8 | 40.6 | 83 | 332 | 2,153 |
| | 1201-1600 | 14 | 229.7 | 41.9 | 77 | 533 | 1,050 |
| Shortspine thornyhead | 501-800 | 27 | 326.1 | 78.8 | 133 | 762 | 2,050 |
| | 801-1200 | 26 | 404.9 | 75.0 | 216 | 668 | 654 |
| | 1201-1600 | 11 | 405.0 | 64.9 | 282 | 569 | 87 |
| Sablefish | 501-800 | 27 | 586.9 | 80.3 | 420 | 935 | 1,254 |
| | 801-1200 | 26 | 583.3 | 66.1 | 456 | 866 | 608 |
| | 1201-1600 | 4 | 675.5 | 66.1 | 516 | 758 | 21 |
| Deepsea sole | 501-800 | 5 | 389.0 | 54.9 | 282 | 456 | 11 |
| | 801-1200 | 14 | 333.5 | 46.8 | 186 | 402 | 82 |
| | 1201-1600 | 6 | 350.8 | 46.6 | 280 | 552 | 31 |
| Dover sole | 501-800 | 28 | 411.3 | 53.9 | 107 | 852 | 1,782 |
| | 801-1200 | 10 | 438.1 | 46.5 | 322 | 640 | 195 |
| Arrowtooth flounder | 501-800 | 11 | 518.2 | 79.7 | 415 | 762 | 83 |
| Roughscale rattail | 501-800 | 4 | 525.5 | 76.7 | 321 | 720 | 95 |
| | 801-1200 | 22 | 492.6 | 96.1 | 170 | 822 | 1,134 |
| | 1201-1600 | 14 | 515.8 | 103.8 | 105 | 790 | 1,132 |
| Pectoral rattail | 501-800 | 11 | 661.8 | 79.5 | 410 | 923 | 103 |
| | 801-1200 | 24 | 641.1 | 100.8 | 54 | 962 | 449 |
| | 1201-1600 | 14 | 699.9 | 115.9 | 111 | 1,265 | 732 |
| Rougheye rockfish | 501-800 | 9 | 424.3 | 101.0 | 295 | 721 | 26 |
| Aurora rockfish | 501-800 | 4 | 341.8 | 26.6 | 312 | 368 | 4 |
| Redbanded rockfish | 501-800 | 1 | 349.5 | 54.4 | 311 | 388 | 2 |
| Shortraker rockfish | 501-800 | 17 | 595.8 | 83.5 | 290 | 802 | 123 |
| | 801-1200 | 1 | 603.3 | 29.1 | 580 | 636 | 3 |
| Brown cat shark | 501-800 | 3 | 474.5 | 55.3 | 386 | 585 | 14 |
| | 801-1200 | 3 | 435.3 | 36.0 | 365 | 495 | 12 |
| Pacific sleeper shark | 501-800 | 1 | 1,012.0 | 1.41 | 1,011 | 1,013 | 2 |
| | 1201-1600 | 1 | 1,175.0 | - | 1,175 | 1,175 | 1 |
| Abyssal skate | 501-800 | 1 | 825.0 | - | 825 | 825 | 1 |
| | 801-1200 | 4 | 849.6 | 245.4 | 668 | 1,282 | 5 |
| | 1201-1600 | 7 | 1,063.0 | 240.4 | 725 | 1,370 | 10 |
| Roughtail skate | 501-800 | 2 | 672.3 | 63.3 | 610 | 752 | 4 |
| | 801-1200 | 7 | 639.3 | 196.0 | 322 | 1,180 | 20 |
| | 1201-1600 | 3 | 595.2 | 152.9 | 440 | 842 | 10 |
| Sandpaper skate | 501-800 | 2 | 551.0 | 45.3 | 519 | 583 | 2 |
| | 801-1200 | 5 | 679.6 | 373.4 | 321 | 1,290 | 5 |
| | 1201-1600 | 2 | 319.0 | 59.9 | 281 | 388 | 3 |
| Longnose skate | 501-800 | 13 | 998.4 | 275.7 | 102 | 1,805 | 28 |
| | 801-1200 | 2 | 103.0 | 13.9 | 87 | 112 | 3 |
| | 1201-1600 | 1 | 854.0 | 82.0 | 796 | 912 | 2 |

**Table 14.** Two alternative biomass estimates in tonnes, plus associated standard errors (SE) and relative errors (RE) from the 2003 survey for the selected species. One set of estimates is calculated from CPUE based on total bottom contact time while the other set uses CPUE estimates where the effort component is derived from winch lockup-to-retrieval times. Two species codes for squid (92A and 95E) and brittle stars (5AA and 5AB) are combined for this table.

| Species | CPUE based on bottom contact time | | | CPUE based on winch lockup to retrieval time | | |
|---|---|---|---|---|---|---|
| | Biomass (t) | SE (t) | RE (%) | Biomass (t) | SE (t) | RE (%) |
| Roughscale rattail | 11,828 | 2,354 | 19.9 | 10,539 | 2,128 | 20.2 |
| Pectoral rattail | 5,731 | 836 | 14.6 | 5,061 | 697 | 13.8 |
| Longspine thornyhead | 4,971 | 554 | 11.2 | 4,720 | 532 | 11.3 |
| Sablefish | 4,772 | 555 | 11.6 | 4,660 | 551 | 11.8 |
| Shortspine thornyhead | 2,482 | 327 | 13.2 | 2,390 | 319 | 13.4 |
| Dover sole | 1,518 | 214 | 14.1 | 1,491 | 216 | 14.5 |
| Pacific flatnose | 899 | 93 | 10.3 | 799 | 77 | 9.6 |
| Tanner crabs | 407 | 68 | 16.7 | 392 | 65 | 16.7 |
| Squids | 292 | 40 | 13.9 | 283 | 38 | 13.6 |
| Shortraker rockfish | 256 | 48 | 18.6 | 248 | 46 | 18.6 |
| Deepsea sole | 197 | 54 | 27.5 | 184 | 50 | 27.4 |
| Longnose skate | 132 | 36 | 27.4 | 128 | 35 | 27.1 |
| Brittle stars | 5 | 2 | 52.3 | 4 | 2 | 51.9 |

**Table 15.** Biomass, standard error (SE) and relative error (RE) estimates by depth zone and areal stratum for longspine thornyhead, shortspine thornyhead and sablefish. These estimates are based on bottom contact time and estimated wingspread measurements converted from the mean doorspread per tow.

| Area | 501-800 m | | | 801-1200 m | | | 1201-1600 m | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Biomass (t) | SE (t) | RE (%) | Biomass (t) | SE (t) | RE (%) | Biomass (t) | SE (t) | RE (%) | Biomass (t) | SE (t) | RE (%) |
| **Longspine thornyhead** | | | | | | | | | | | | |
| A | 159.0 | 91.7 | 57.7 | 1,515.6 | 480.4 | 31.7 | 360.3 | 33.3 | 9.2 | 2,034.9 | 490.2 | 24.1 |
| B | 57.4 | 18.2 | 31.7 | 313.8 | 52.3 | 16.7 | 128.7 | 64.1 | 49.8 | 499.8 | 84.7 | 16.9 |
| C | 13.4 | 4.4 | 32.7 | 220.7 | 9.4 | 4.3 | 67.0 | 55.3 | 82.5 | 301.0 | 56.3 | 18.7 |
| D | 31.9 | 22.7 | 71.2 | 364.8 | 52.8 | 14.5 | 204.2 | 19.3 | 9.5 | 600.9 | 60.7 | 10.1 |
| E | 51.9 | 21.8 | 42.0 | 333.7 | 84.3 | 25.3 | 80.4 | 18.3 | 22.7 | 465.9 | 88.9 | 19.1 |
| F | 24.9 | 15.3 | 61.6 | 524.7 | 162.3 | 30.9 | 85.0 | 13.4 | 15.8 | 634.6 | 163.5 | 25.8 |
| G | 19.3 | 2.2 | 11.4 | 208.6 | 62.6 | 30.0 | 205.7 | 120.0 | 58.3 | 433.6 | 135.4 | 31.2 |
| **Total** | **357.6** | **99.9** | **27.9** | **3,481.8** | **523.2** | **15.0** | **1,131.3** | **153.5** | **13.6** | **4,970.8** | **554.3** | **11.2** |
| **Shortspine thornyhead** | | | | | | | | | | | | |
| A | 237.1 | 40.4 | 17.0 | 197.4 | 64.8 | 32.8 | 82.0 | 3.6 | 4.4 | 516.5 | 76.5 | 14.8 |
| B | 104.0 | 17.1 | 16.4 | 89.7 | 34.6 | 38.6 | 46.9 | 46.9 | 100.0 | 240.6 | 60.8 | 25.3 |
| C | 93.5 | 25.3 | 27.1 | 62.7 | 16.3 | 26.0 | 6.2 | 6.2 | 100.0 | 162.4 | 30.8 | 18.9 |
| D | 132.6 | 37.6 | 28.3 | 54.4 | 13.4 | 24.7 | 8.4 | 8.4 | 100.0 | 195.5 | 40.8 | 20.9 |
| E | 379.6 | 89.3 | 23.5 | 139.1 | 31.1 | 22.4 | 26.9 | 0.5 | 2.0 | 545.6 | 94.5 | 17.3 |
| F | 155.4 | 18.1 | 11.7 | 361.8 | 291.5 | 80.6 | 60.8 | 2.8 | 4.6 | 578.0 | 292.1 | 50.5 |
| G | 105.7 | 18.1 | 17.1 | 110.6 | 20.9 | 18.9 | 27.4 | 0.4 | 1.3 | 243.7 | 27.6 | 11.3 |
| **Total** | **1,207.9** | **112.3** | **9.3** | **1,015.7** | **303.7** | **29.9** | **258.7** | **48.3** | **18.7** | **2,482.3** | **327.3** | **13.2** |
| **Sablefish** | | | | | | | | | | | | |
| A | 1,001.0 | 336.9 | 33.7 | 307.4 | 100.4 | 32.7 | 168.8 | 89.6 | 53.1 | 1,477.20 | 362.7 | 24.6 |
| B | 146.8 | 40.7 | 27.7 | 184.0 | 54.8 | 29.8 | 57.5 | 57.5 | 100.0 | 388.3 | 89.3 | 23.0 |
| C | 424.5 | 156.8 | 36.9 | 105.3 | 36.0 | 34.2 | 0.0 | 0.0 | | 529.8 | 160.9 | 30.4 |
| D | 609.1 | 189.3 | 31.1 | 135.6 | 67.5 | 49.7 | 0.0 | 0.0 | | 744.7 | 200.9 | 27.0 |
| E | 213.9 | 45.2 | 21.1 | 113.3 | 39.0 | 34.4 | 24.5 | 24.5 | 100.0 | 351.7 | 64.5 | 18.3 |
| F | 33.6 | 10.2 | 30.3 | 725.0 | 279.2 | 38.5 | 20.2 | 20.2 | 100.0 | 778.8 | 280.1 | 36.0 |
| G | 183.9 | 12.2 | 6.6 | 317.3 | 138.1 | 43.5 | 0.0 | 0.0 | | 501.2 | 138.6 | 27.7 |
| **Total** | **2,612.8** | **421.7** | **16.1** | **1,887.8** | **342.7** | **18.2** | **271.0** | **111.1** | **41.0** | **4,771.7** | **554.7** | **11.6** |

**Table 16.** Comparison of biomass estimates for 2001-2003 using winch time span and a fixed wingspread of 20 m. Estimates include biomass (B) and standard error (SE) in metric tonnes and relative error (RE) as a percentage. Only areas A-F are considered for these calculations since the 2001 survey did not cover area G. Two species codes for squid (92A and 95E) and brittle stars (5AA and 5AB) are combined for this table.

| Species | 2001 | | | 2002 | | | 2003 | | |
|---|---|---|---|---|---|---|---|---|---|
| | B (t) | SE (t) | RE (%) | B (t) | SE (t) | RE (%) | B (t) | SE (t) | RE (%) |
| Roughscale rattail | 6,431 | 747 | 11.6 | 5,915 | 804 | 13.6 | 6,790 | 1,490 | 21.9 |
| Pectoral rattail | 4,167 | 492 | 11.8 | 3,904 | 594 | 15.2 | 3,535 | 606 | 17.1 |
| Longspine thornyhead | 3,191 | 302 | 9.5 | 3,204 | 337 | 10.5 | 3,151 | 425 | 13.5 |
| Sablefish | 3,824 | 505 | 13.2 | 2,893 | 578 | 20.0 | 3,302 | 464 | 14.1 |
| Shortspine thornyhead | 1,531 | 119 | 7.8 | 1,725 | 126 | 7.3 | 1,743 | 208 | 11.9 |
| Dover sole | 845 | 112 | 13.3 | 1,068 | 231 | 21.6 | 986 | 144 | 14.6 |
| Pacific flatnose | 824 | 100 | 12.2 | 776 | 130 | 16.7 | 553 | 70 | 12.6 |
| Tanner crabs | 538 | 98 | 18.3 | 299 | 40 | 13.5 | 282 | 48 | 16.9 |
| Squids | 112 | 27 | 24.0 | 162 | 26 | 16.1 | 207 | 33 | 15.7 |
| Deepsea sole | 104 | 18 | 17.6 | 221 | 76 | 34.5 | 104 | 29 | 27.8 |
| Longnose skate | 504 | 257 | 51.1 | 127 | 46 | 35.9 | 109 | 30 | 27.3 |
| Brittle stars | 349 | 313 | 89.6 | 734 | 260 | 35.4 | 2 | 1 | 47.3 |

**Table 17.** Biomass estimates in tonnes, plus associated standard errors (SE) and relative errors (RE) from the 2002 and 2003 surveys for selected species. Data selection includes all valid biomass tows in areas A-G. Tow distances are based on bottom contact time and separate wingspread values are used for each tow. Two species codes for squid (92A and 95E) and brittle stars (5AA and 5AB) are combined for this table.

| Species | 2002 | | | 2003 | | |
|---|---|---|---|---|---|---|
| | Biomass (t) | SE (t) | RE (%) | Biomass (t) | SE (t) | RE (%) |
| Roughscale rattail | 9,504 | 1,118 | 11.8 | 11,828 | 2,354 | 19.9 |
| Pectoral rattail | 5,791 | 804 | 13.9 | 5,731 | 836 | 14.6 |
| Longspine thornyhead | 4,875 | 463 | 9.5 | 4,971 | 554 | 11.2 |
| Sablefish | 4,347 | 689 | 15.8 | 4,772 | 555 | 11.6 |
| Shortspine thornyhead | 2,607 | 184 | 7.1 | 2,482 | 327 | 13.2 |
| Dover sole | 1,815 | 317 | 17.5 | 1,518 | 214 | 14.1 |
| Pacific flatnose | 1,264 | 172 | 13.6 | 899 | 93 | 10.3 |
| Tanner crabs | 409 | 56 | 13.8 | 407 | 68 | 16.7 |
| Squids | 244 | 38 | 15.5 | 292 | 40 | 13.9 |
| Shortraker rockfish | 380 | 94 | 24.7 | 256 | 48 | 18.6 |
| Deepsea sole | 339 | 120 | 35.3 | 197 | 54 | 27.5 |
| Longnose skate | 167 | 57 | 34.3 | 132 | 36 | 27.4 |
| Brittle stars | 1,694 | 735 | 43.4 | 5 | 2 | 52.3 |

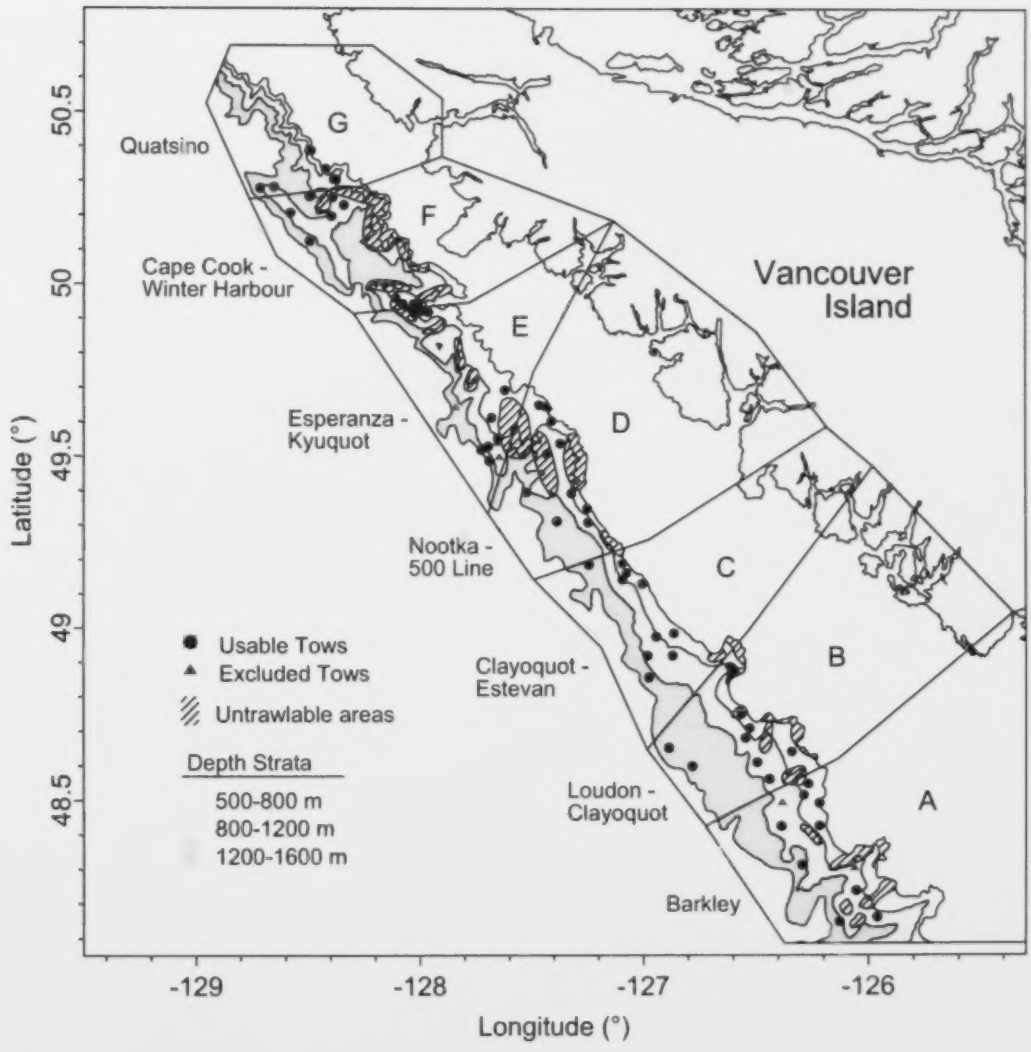


**Figure 1.** Coastal waters of Vancouver Island illustrating the 7 area strata and 3 depth strata defined for the 2003 survey. Locations of usable and excluded survey tows are shown, along with areas that were considered untrawlable and excluded from site selection. See Table 1 for estimated surface areas within area strata A-G.

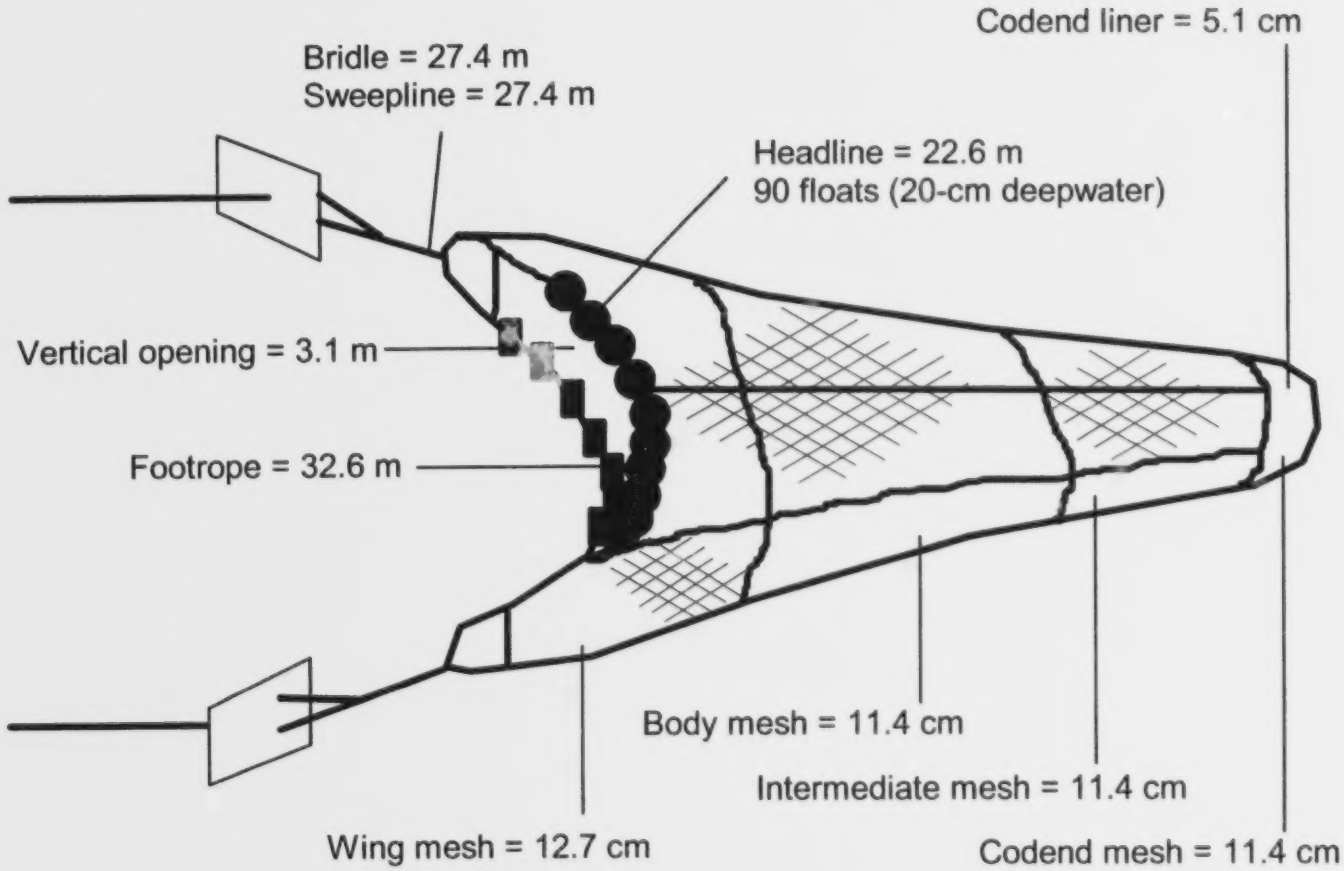
Codend liner = 5.1 cm
Bridle = 27.4 m
Sweepline = 27.4 m
Headline = 22.6 m
90 floats (20-cm deepwater)
Vertical opening = 3.1 m
Footrope = 32.6 m
Body mesh = 11.4 cm
Intermediate mesh = 11.4 cm
Wing mesh = 12.7 cm
Codend mesh = 11.4 cm

**Figure 2.** Net specifications for the Atlantic Western II box trawl.

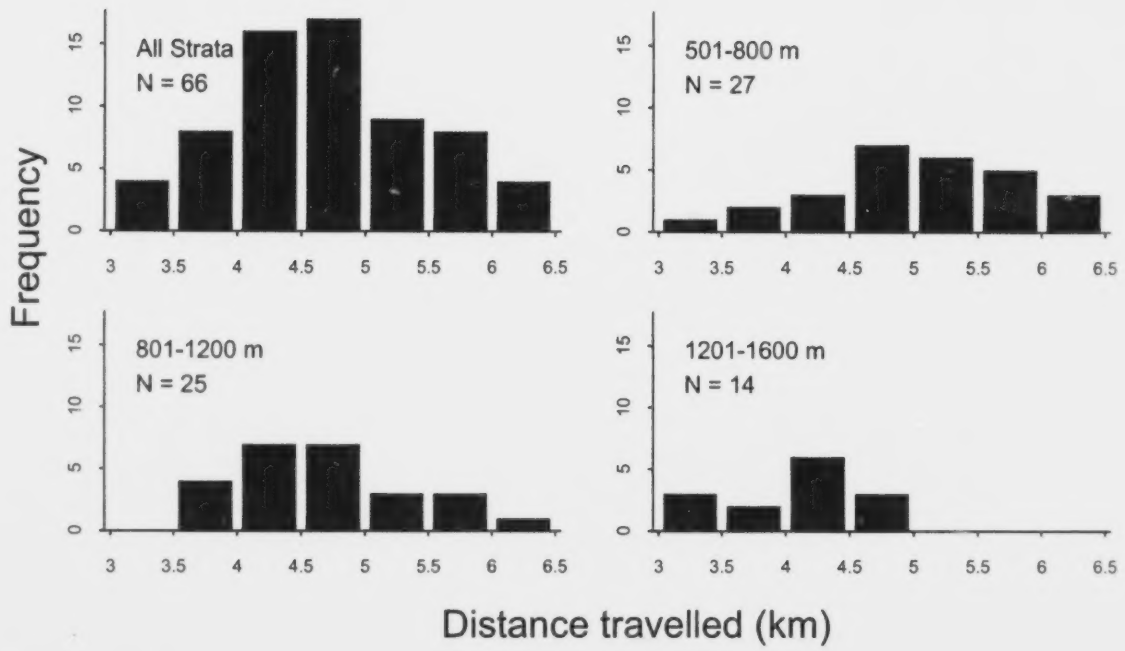


**Figure 3.** Frequency distributions of tow distances (km) for the entire survey and by depth stratum using data from valid biomass tows. Tow distances are estimated using interval data from first-to-last bottom contact based on bottom contact sensor readings.

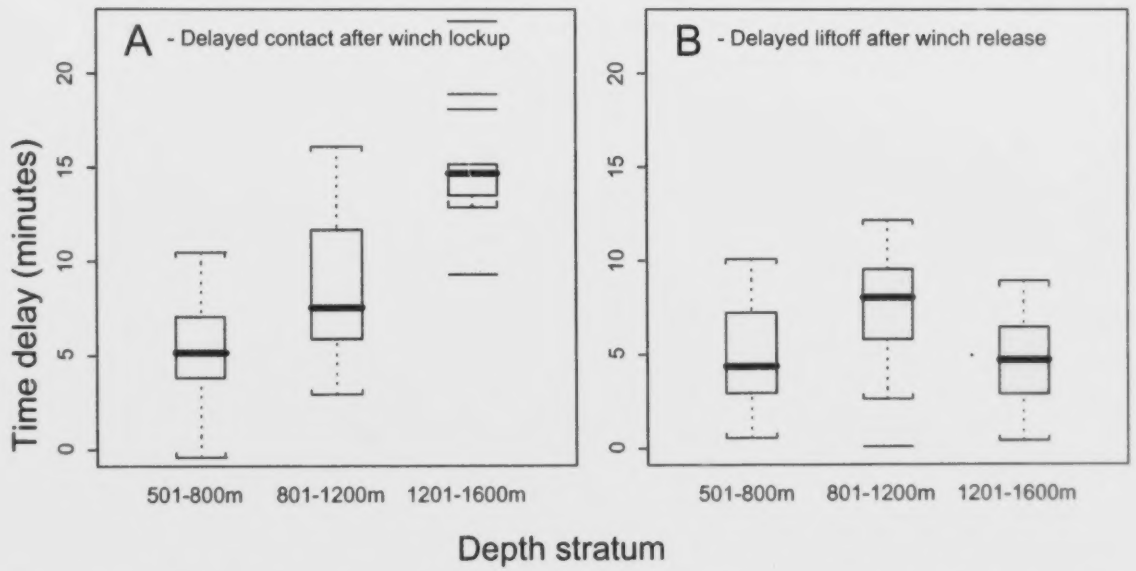


**Figure 4.** Distribution of time delays for: A) first gear contact with bottom after winch lockup, and B) last gear contact with bottom after winch release for all survey tows.

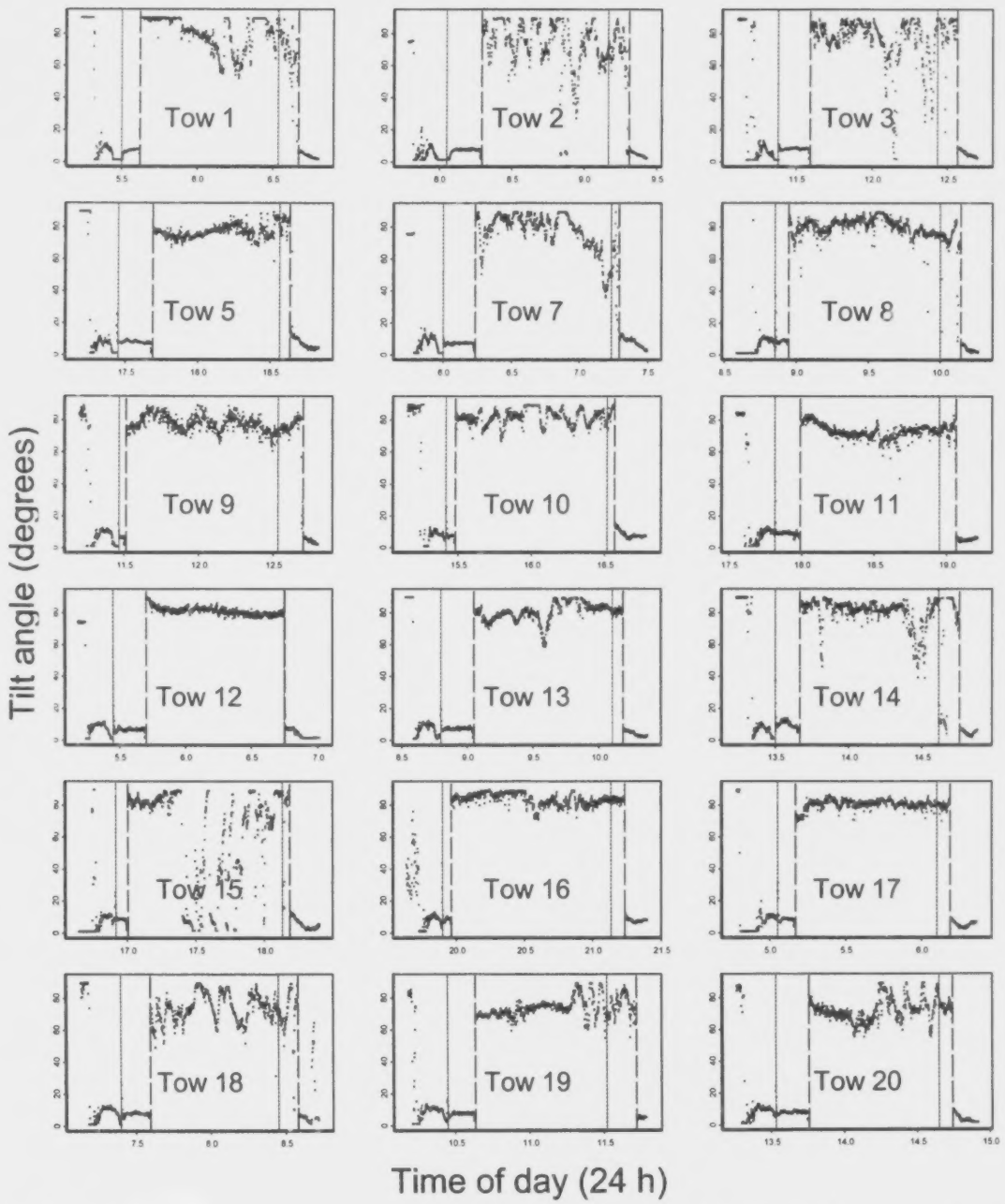


**Figure 5.** Bottom contact sensor profiles for Tows 1 to 20 from the 2003 WCVI longspine thornyhead survey. Time of day is given as decimal hours for a 24-hour clock. Solid vertical lines are the recorded times of winch lockup and release, and dashed vertical lines are the selected times for first and last gear contact with bottom during the tow based on bottom contact data. Tows 4 and 6 (not shown) are rejected tows.

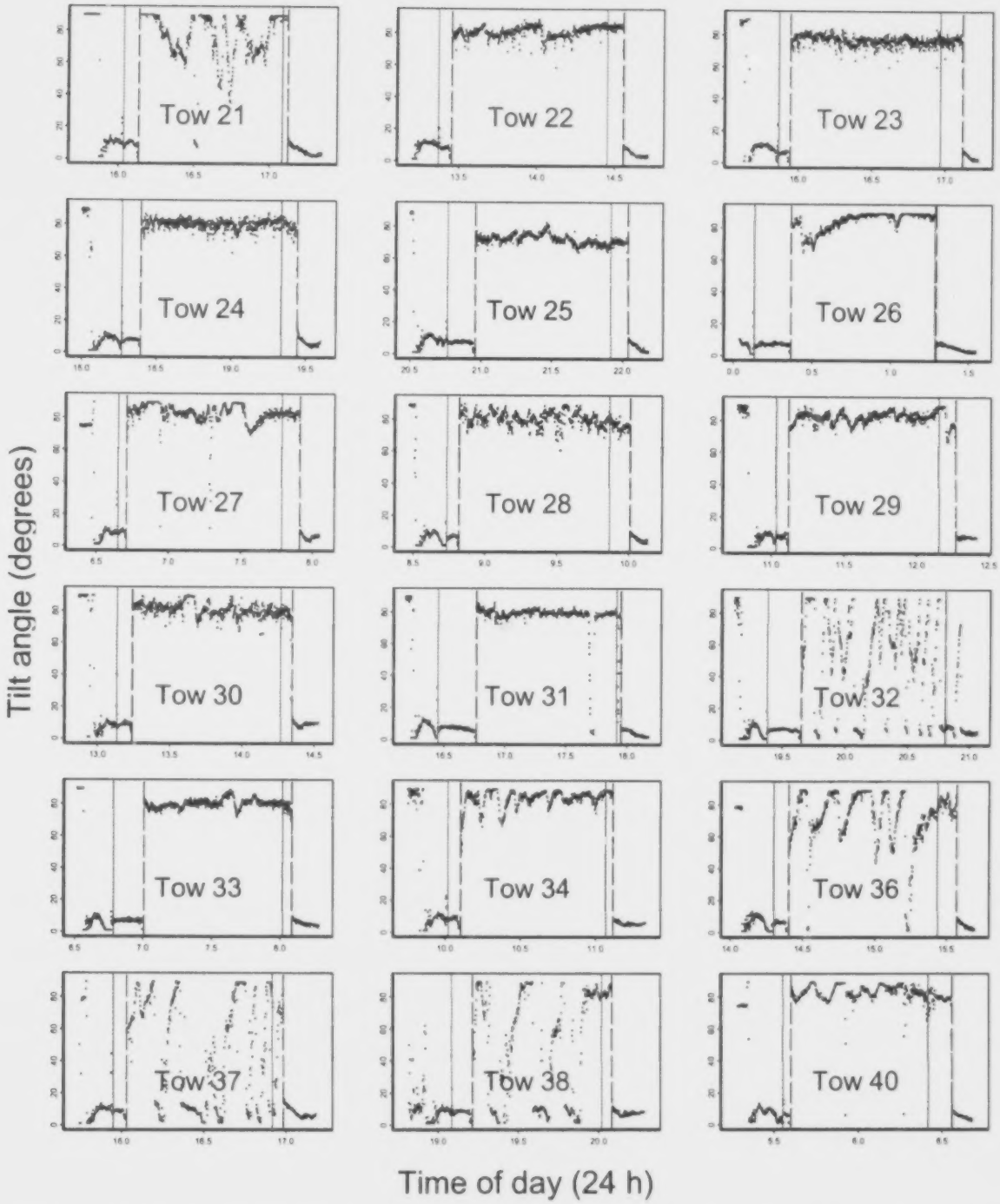


**Figure 5** (continued). Bottom contact sensor profiles for tows 21 to 40. Tows 35 and 39 (not shown) are rejected tows.

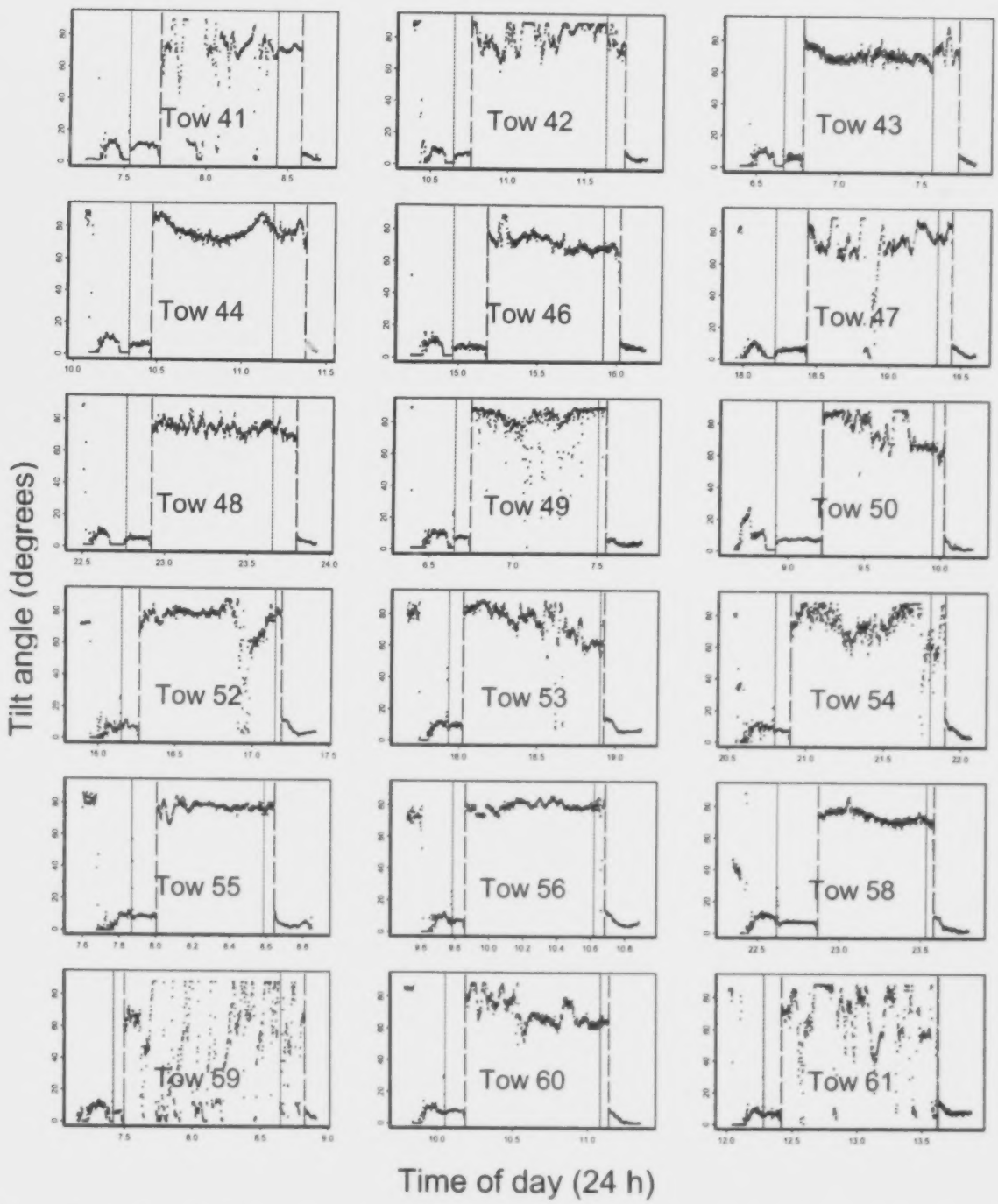


**Figure 5** (continued). Bottom contact sensor profiles for tows 41 to 61. The bottom contact sensor was lost during Tow 51. Tows 45 and 57 (not shown) are rejected tows.

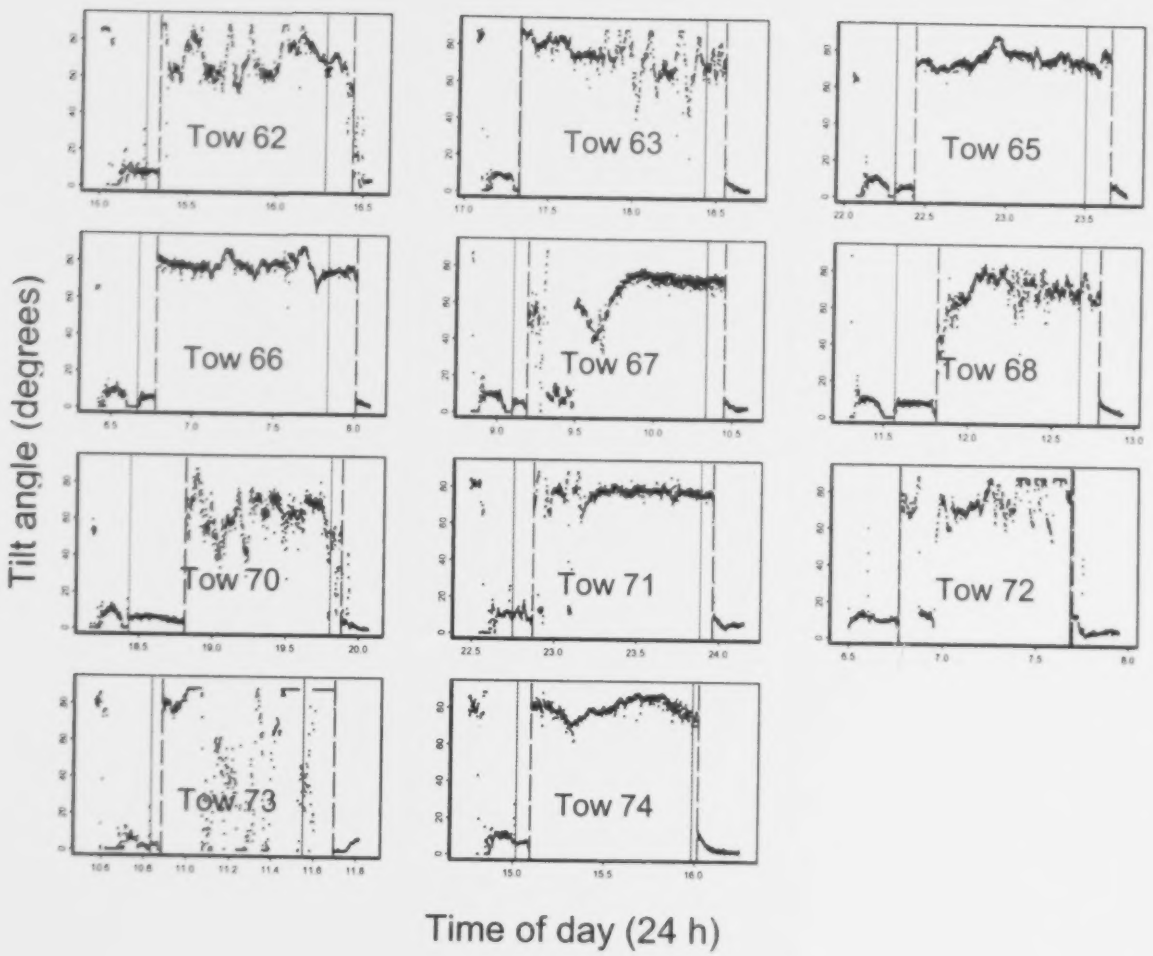


**Figure 5** (continued). Bottom contact sensor profiles for tows 62 to 74. Tows 64 and 69 (not shown) are rejected tows.

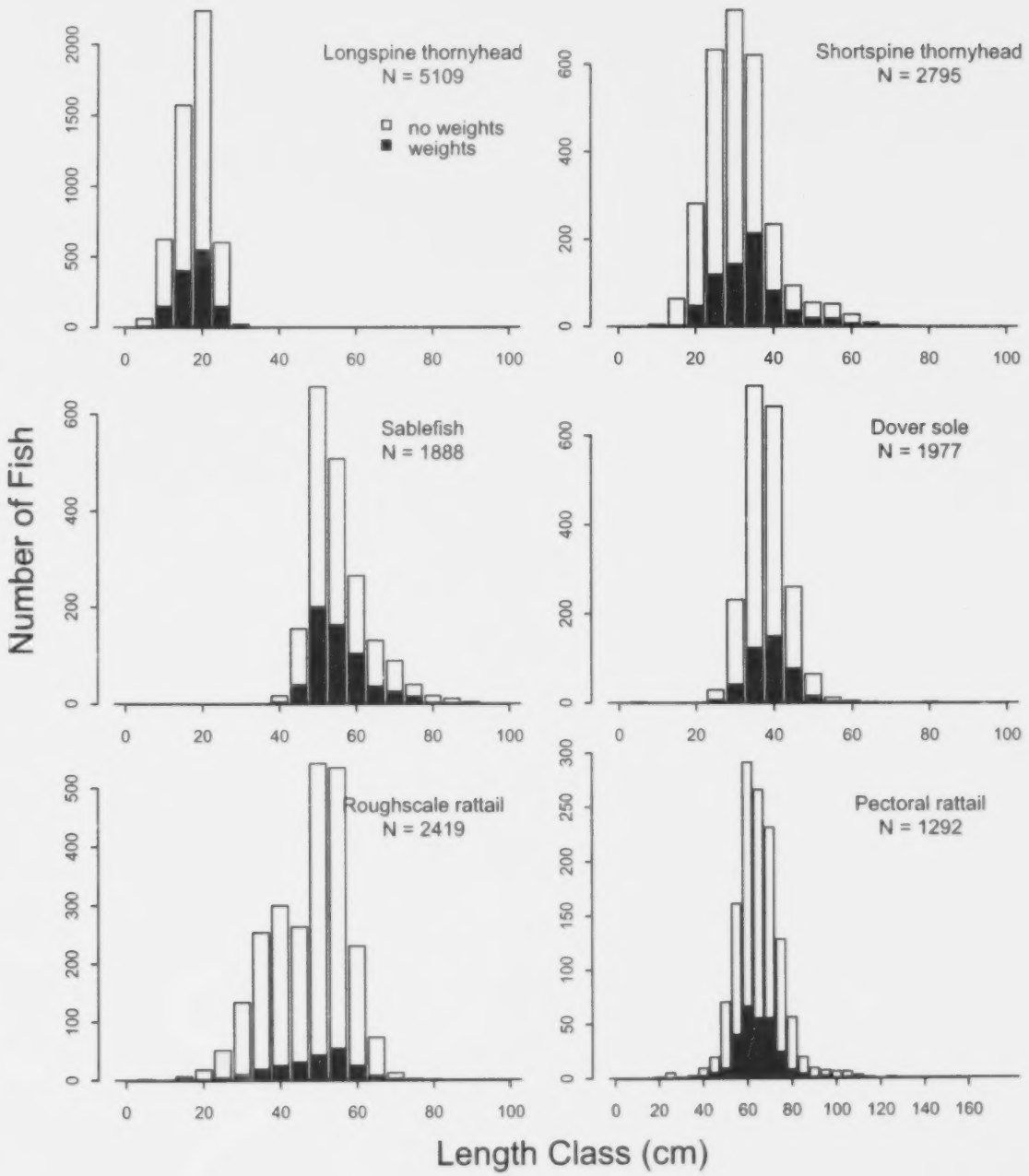


**Figure 6.** Unscaled size distributions from samples collected by species, giving numbers of specimens with length measurements and the subsample that was weighed individually (black bars). N is the total number of specimens.

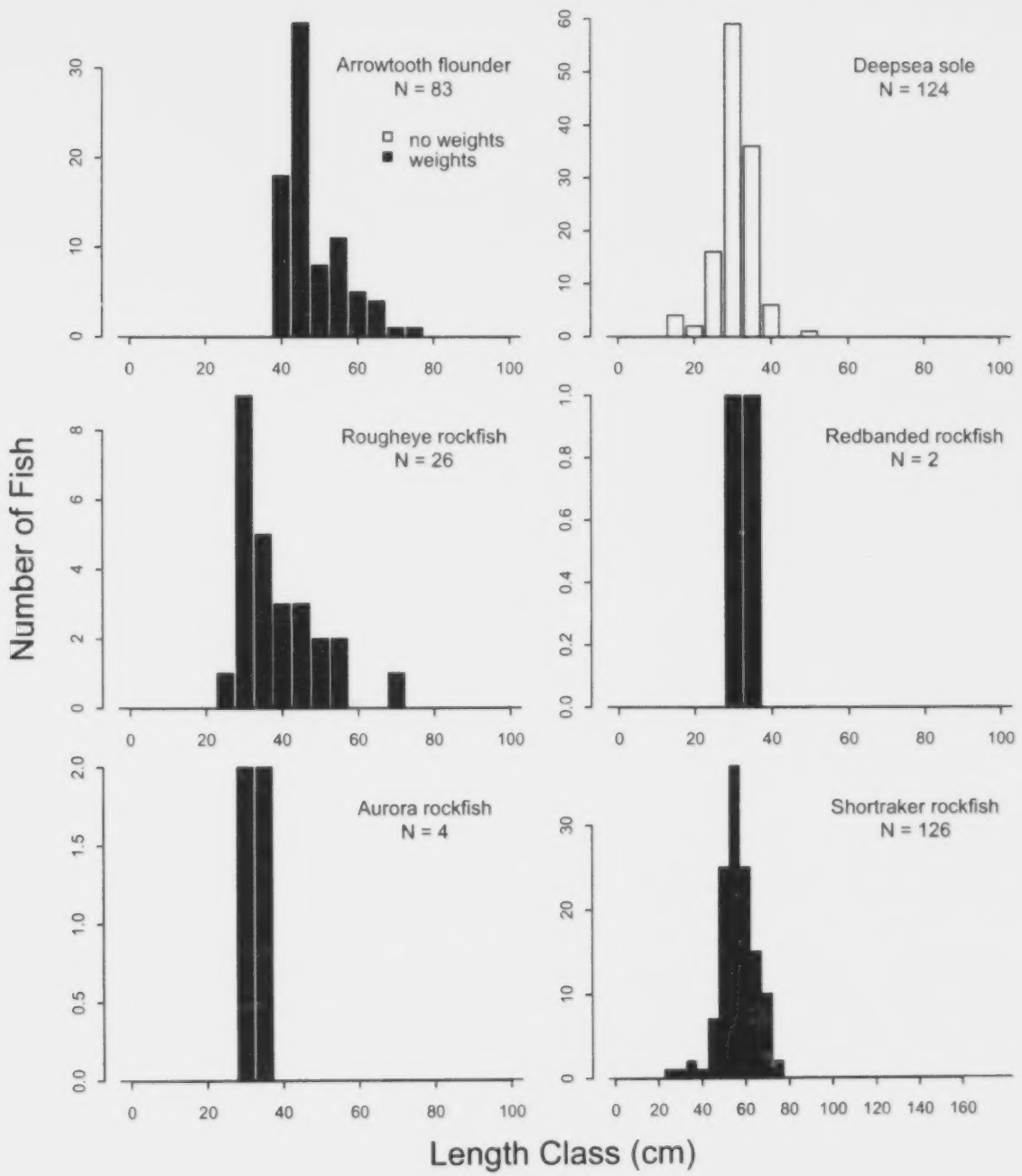


**Figure 6** (continued). Unscaled size distributions.

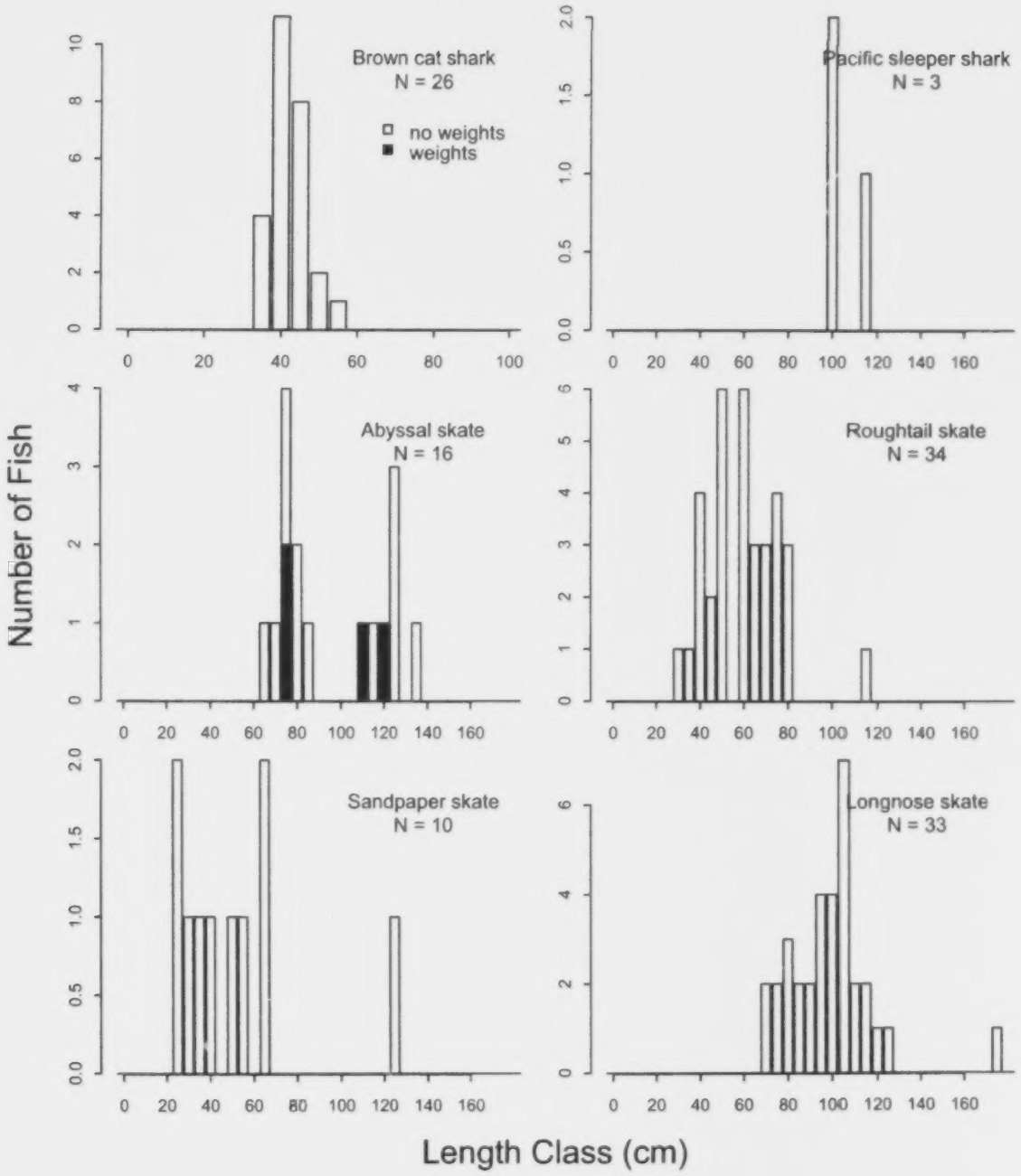


**Figure 6** (continued). Unscaled size distributions.

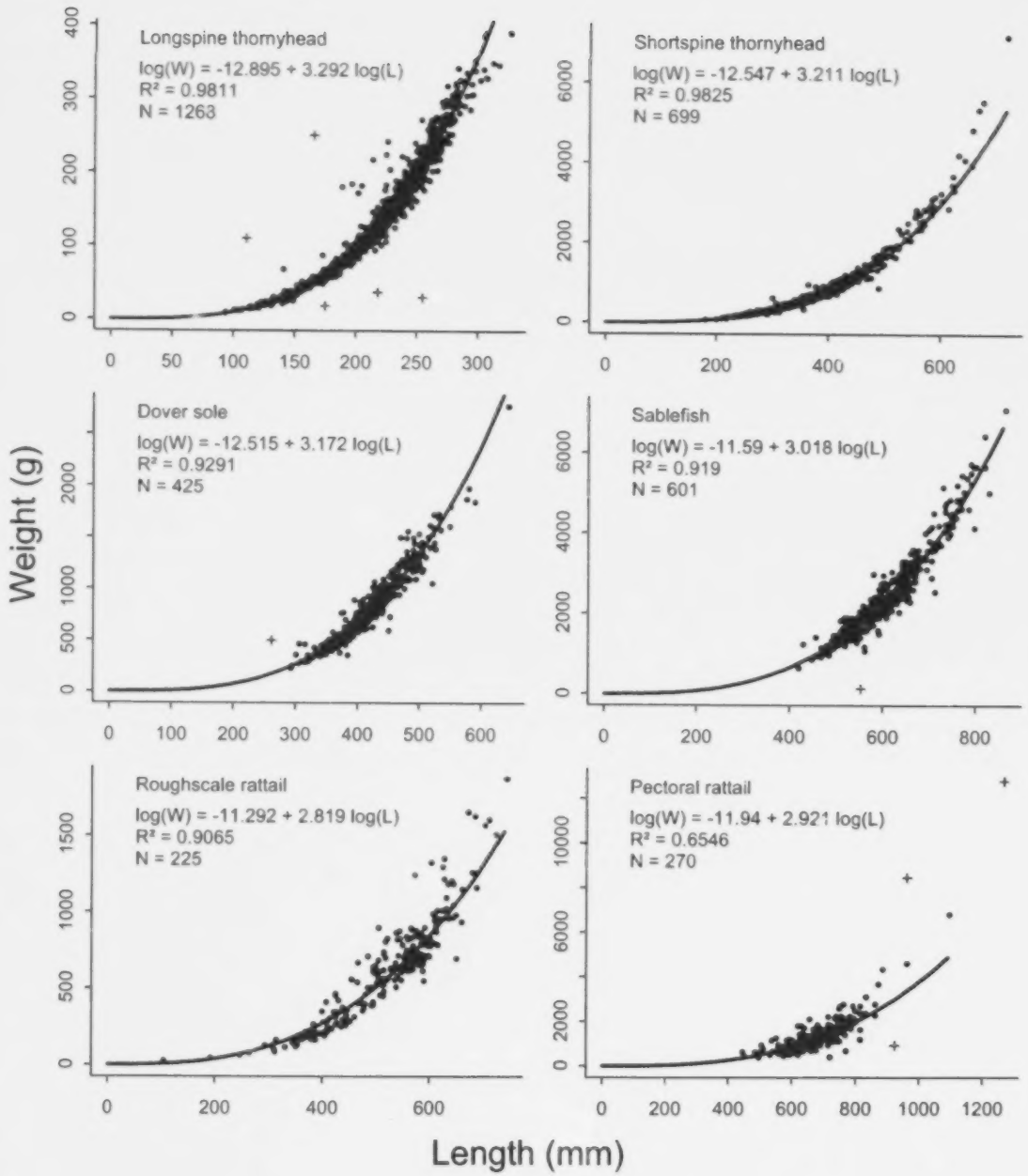


**Figure 7.** Regression plots of weight (g) versus length (mm) for six species. Data include specimens from excluded tows where biological samples were collected. Outliers (+) were removed from analyses.

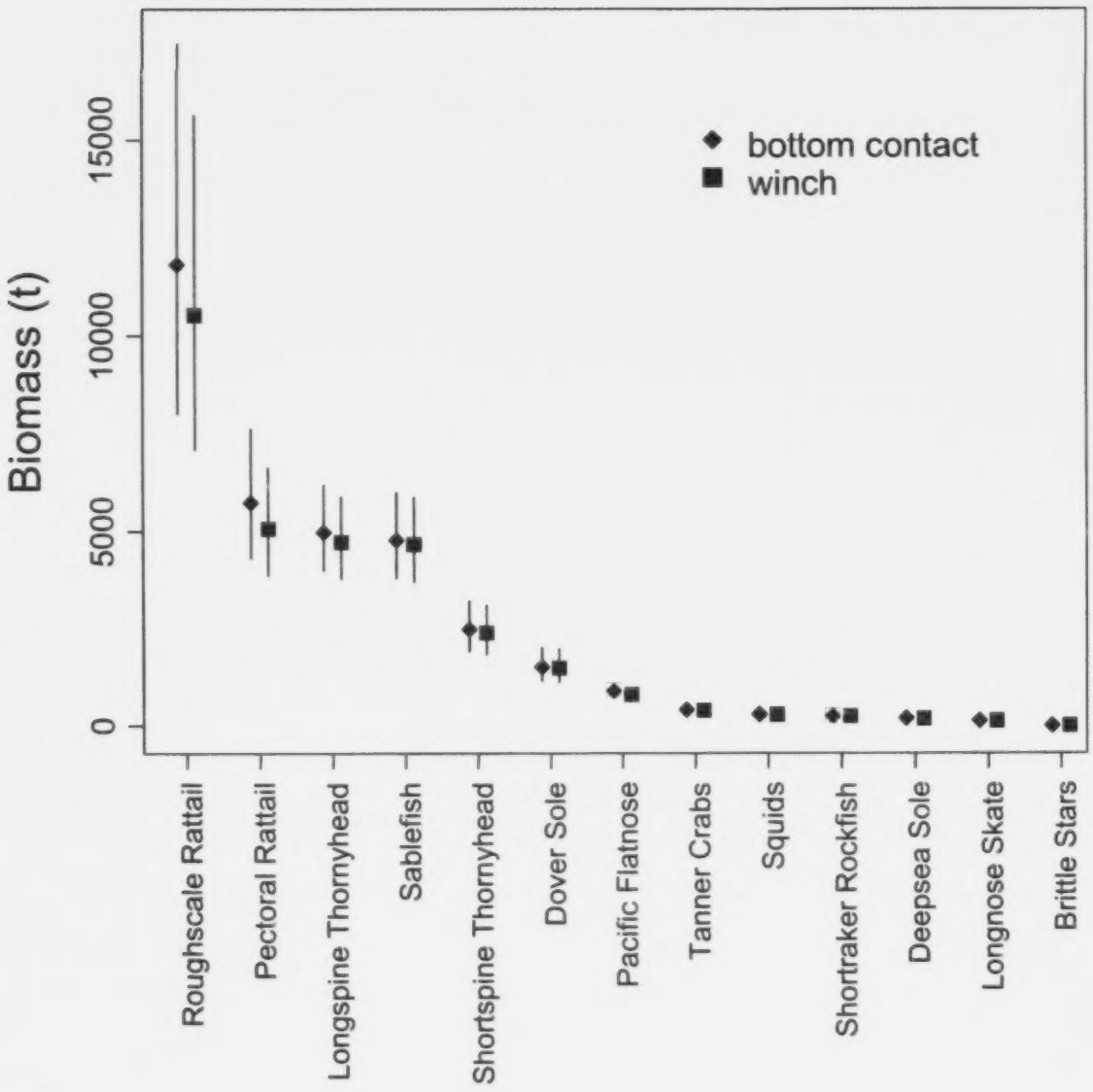


**Figure 8.** Comparison of biomass estimates for 13 species in the 2003 survey using CPUE estimates based on total bottom contact time and CPUE estimates calculated using winch lockup to retrieval time (Eq. 4). Approximate confidence bounds are indicated based on a log-normal distribution using the analytic CV for plotting only.

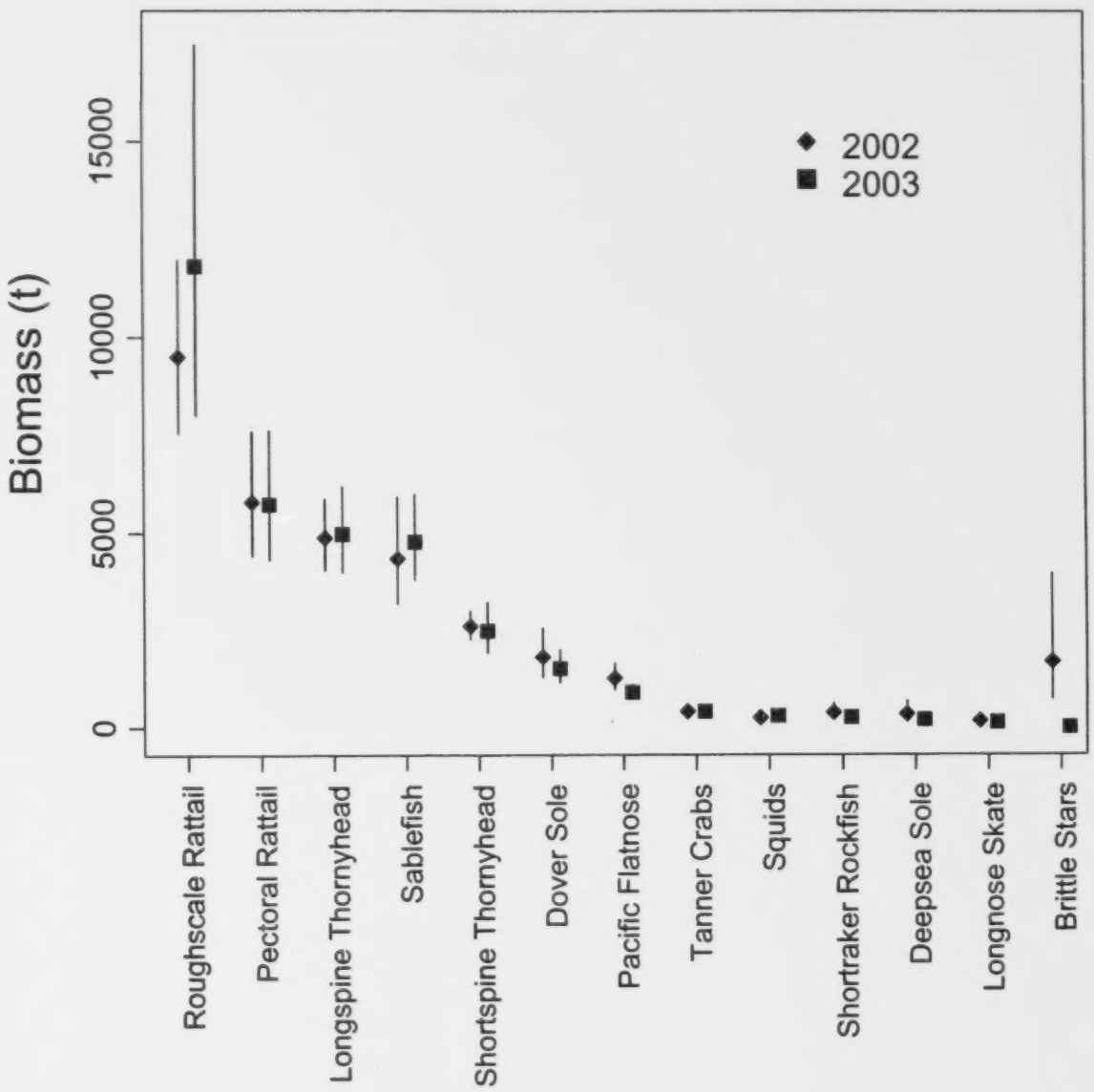


**Figure 9.** Comparison of biomass estimates for 13 species from the 2002 and 2003 surveys using CPUE estimates based on total bottom contact time (Eq. 4). Approximate confidence bounds are indicated based on a log-normal distribution using the analytic CV for plotting only.

# APPENDICES

**APPENDIX A.** Design for the 2003 west coast Vancouver Island longspine thornyhead survey.
(Paul Starr, Canadian Groundfish Research & Conservation Society, 2003)

## Introduction

The design for a longspine thornyhead trawl survey presented in this document is a revision of documents drafted for the 2001 and 2002 surveys (Starr et al. 2002; Starr et al. in prep.). The initial design considerations for this survey were presented to the Groundfish Sub-committee of the Pacific Stock Assessment Review Committee in 2000 (Starr & Schwarz 2000). These were subsequently refined and revised based on discussions over a period of nearly eight months between scientists from the Pacific Biological Station, Simon Fraser University, the Canadian Groundfish Research & Conservation Society (CGRCS), and the US National Marine Fisheries Service (NMFS). There was also consultation with Department of Fisheries and Oceans (DFO) management and with representatives of the fishing industry. The 2001 survey was conducted from 15 September to 02 October on the *F/V Viking Storm* (Starr et al. 2002) and was repeated from 06 to 23 September 2002 on the F/V Ocean Selector (Starr et al. in prep.). A preliminary comparison of the results of the two surveys shows excellent comparability (Starr 2003).

The design of these trawl surveys is targeted at the longspine thornyhead resource. This aspect is reflected in the depth range selected for the survey and the survey coverage which is restricted to the west coast of Vancouver Island (WCVI). The reasons for this decision are:

a. all parties recognize that the developing thornyhead fishery requires robust fisheries data which can be incorporated into future stock assessments;

b. thornyheads appear to be distributed relatively uniformly on the bottom (Wakefield 1990) compared to other slope/shelf rockfish species which translated into a low relative error (RE) in the initial survey;

c. this survey represents the third year of a three-year commitment on the part of the CGRCS to support new research on longspine thornyheads.

## Objectives of the survey

1. To estimate the relative abundance of longspine thornyhead lying between a southern boundary defined by the Canada-US border and a northern boundary defined approximately by 50° 30' N between the depths 500 m and 1 600 m. The target RE of the biomass estimate is 20% $(RE = \mu/SE)$ (where $\mu$ is the mean biomass for the survey and $SE$ is the standard error of the biomass estimate).
2. To estimate the distribution by size class and sex category of the longspine thornyhead population within the extent of the survey area, given the uncertainty that results from sampling with non-representative fishing gear.
3. To obtain quantitative biological information pertaining to selected finfish and invertebrate species.

## Survey Charter and Personnel

4. As in 2002, the charter for the 2003 WCVI longspine survey will be performed by the *F/V Ocean Selector* with Dave Clattenberg as skipper.

5. The survey leader will be Paul Starr of the Canadian Groundfish Society. He will be on board the Ocean Selector for the first four to five days of the survey. Brian Krishka and Ed Choromanski of DFO will be on board the Ocean Selector for the full duration of the survey and Nev Venables (formerly of DFO) is scheduled come on board when Paul Starr disembarks. Archipelago Marine Research will provide Dean Gaidica (who participated in the 2001 survey) and Mike Orcutt (who participated in the 2002 survey) to assist with the sampling and the data recording for the entire period of the survey

## Elements of this design

6. The survey will be targeted at the vulnerable slope and shelf rockfish species between the depths of 500 and 1600 m. It will be conducted off WCVI and will use the seven areal strata used in the 2002 survey (Figure A1; Table A1). The initial survey design in 2001 was based on six strata, but a seventh areal stratum was added in 2002 to accommodate the revised northern limit (at 50° 30') of the southern longspine thornyhead management area (Figure A1). The boundaries between these seven areal strata were selected to reflect the natural boundaries of the existing longspine thornyhead fishery. Although the analysis of both the 2001 and 2002 survey data indicated that the areal stratification did not substantially improve the statistical performance of the survey, the use of these strata ensures good geographical coverage by the survey.

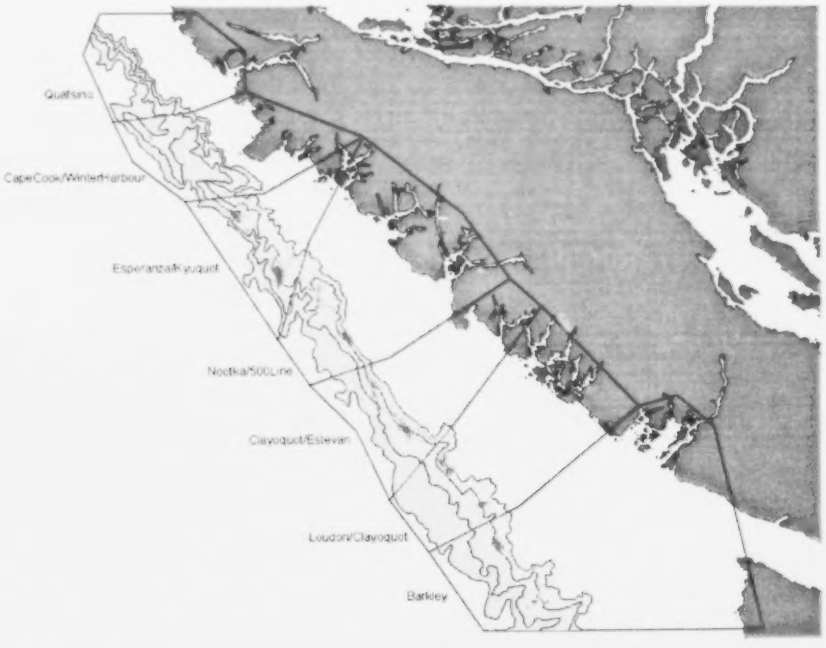


**Figure A1.** Map of the seven areal survey strata with most of the relevant tows in the PacHarvest database (over period 15 February 1996 to 01 April 2002).

7. Each areal stratum is divided into three depth strata: 501–800 m; 801–1200 m; 1201–1600 m (Table A1). The use of these depth strata reduced the calculated RE for longspine thornyheads from about 15% for a completely random survey to around 10% when only using the depth strata. The inclusion of these depth strata therefore significantly improved the performance of the survey design.

**Table A1.** Names and approximate size of each areal stratum by depth stratum. Trawlable area estimated from the number of $(500\ m)^2$ cells used to select the random tows.

| | | Estimated size of trawlable area ($km^2$) | | | |
|---|---|---|---|---|---|
| **Areal stratum name** | | **501-800 m** | **801-1200 m** | **1201-1600 m** | **Total** |
| A. | Barkley | 491 | 689 | 588 | 1,768 |
| B. | Loudon/Clayoquot | 331 | 370 | 698 | 1,398 |
| C. | Clayoquot/Estevan | 265 | 379 | 462 | 1,106 |
| D. | Nootka/500 Line | 265 | 388 | 452 | 1,105 |
| E. | Esperanza/Kyuquot | 425 | 361 | 260 | 1,046 |
| F. | Cape Cook/Winter Harbour | 191 | 540 | 574 | 1,305 |
| G. | Quatsino | 131 | 215 | 304 | 650 |
| | Total | 2,099 | 2,941 | 3,337 | 8,377 |

8. The number of tows allocated to each areal stratum is designed to ensure that a reasonably high level of precision for longspine thornyheads is achieved over the entire survey area, based on an analysis of the existing catch and effort data for longspine thornyheads (Starr & Schwarz 2000). The design requires 10 tows per areal stratum, 4 tows in each of the two shallower strata and 2 tows in the deepest stratum (with the exception of the northernmost areal stratum). This number of tows per stratum resulted in acceptable REs for all the main species caught in the 2001 survey except for longnose skate, brittle stars and shortraker rockfish and reasonable estimates of RE for all the major species in 2002 (Table A2)). The number of tows required in the most northerly stratum (Quatsino; Figure A1) has been set to a lower number than the more southerly areal strata as the terrain is likely to be very difficult to tow and there have been very few commercial sets in this area.

**Table A2.** Biomass estimates (t) and the associated relative errors (RE [%]) for the top 13 species by total weight caught in the 2001 and 2002 west coast Vancouver Island longspine thornyhead surveys (Starr 2003). The 2002 survey estimates have been made for the areal strata A to F (Table A1) only and are based on tow durations from winch lockup to winch release for comparability with the 2001 survey estimates.

| **Species** | **2001 biomass (t)** | **2002 biomass (t)** | **Difference (%)** | **2001 survey RE** | **2002 survey RE** |
|---|---|---|---|---|---|
| Sablefish | 3,824 | 2,899 | -24% | 13.2% | 19.9% |
| Roughscale rattail | 6,431 | 5,906 | -8% | 11.6% | 13.6% |
| Longspine thornyhead | 3,191 | 3,210 | 1% | 9.5% | 10.5% |
| Shortspine thornyhead | 1,531 | 1,721 | 12% | 7.8% | 7.3% |
| Pectoral rattail | 4,167 | 3,900 | -6% | 11.8% | 15.4% |
| Dover sole | 845 | 1,071 | 27% | 13.3% | 21.5% |
| Pacific flatnose | 824 | 776 | -6% | 12.2% | 16.8% |
| Tanner crabs | 538 | 299 | -45% | 18.3% | 13.5% |
| Shortraker rockfish | 15 | 219 | 1,352% | 71.4% | 24.4% |
| Brittle stars | 414 | 731 | 76% | 76.4% | 35.3% |
| Longnose skate | 504 | 127 | -75% | 51.1% | 35.8% |
| Squids | 115 | 162 | 41% | 23.3% | 16.0% |
| Deepsea sole | 104 | 220 | 112% | 17.6% | 34.3% |

9. Table A3 defines the depth strata selected for this design and the target and minimum times to be towed in each depth stratum, based on the time from winch lockup to winch release. The target tow time has been set between ¾ and 1 hour to minimize large catches and to reduce sub-sampling as well as ensuring comparability with the 2001 and 2002 surveys. The actual tow times may be shorter or longer than the target, depending on bottom conditions or other considerations but should not be less than the specified minimum times. The target and minimum tow time have been adjusted downward for the three northern strata (Esperanza/Kyuquot; Cape Cook/Winter Harbour and Quatsino) because towing conditions in these strata are more difficult.

**Table A3.** Specifications for target and minimum times between winch lockup and winch release by depth stratum. Strata are labelled A to G as shown in Table A1.

| | | Strata A-D | | Strata E-G | |
|---|---|---|---|---|---|
| Depth Stratum | Number of assigned tows | Target length of tow in stratum[1] | Minimum length of tow in stratum[1] | Target length of tow in stratum[1] | Minimum length of tow in stratum[1] |
| 501 – 800 m | 4[2] | 1.0 h | 0.75 h | 0.75 h | 0.50 h |
| 801 – 1200 m | 4[2] | 1.0 h | 0.75 h | 0.75 h | 0.50 h |
| 1201 – 1600 m | 2 | 1.0 h | 0.75 h | 0.75 h | 0.50 h |

[1] Defined as the time between winch lockup and the beginning of winch release.
[2] Reduced to two tows in Stratum G.

10. The design provided in Table A4 is based on the assumption that tows will be chosen randomly from a prescribed list of locations. If a tow location is not feasible, then another tow will be selected from a list of alternative random tow locations in a specified sequence.

**Table A4.** Survey design based on equal allocation of tows to each of the 7 areas defined in Figure A1 and Table A1.

| | | Depth stratum (m) | | | Total |
|---|---|---|---|---|---|
| Areal stratum | | 501-800 | 801-1200 | 1201-1600 | all depths |
| A. | Barkley | 4 | 4 | 2 | 10 |
| B. | Loudon/Clayoquot | 4 | 4 | 2 | 10 |
| C. | Clayoquot/Estevan | 4 | 4 | 2 | 10 |
| D. | Nootka/500 Line | 4 | 4 | 2 | 10 |
| E. | Esperanza/Kyuquot | 4 | 4 | 2 | 10 |
| F. | Cape Cook/Winter Harbour | 4 | 4 | 2 | 10 |
| G. | Quatsino | 2 | 2 | 2 | 6 |
| | Total | 26 | 26 | 14 | 66 |

11. The minimum tow period in this survey has become more difficult to specify due to changes in the way that the bottom contact sensor behaved between the 2001 and 2002 surveys. Table A5 shows the average by stratum for five (for 2002) and three (for 2001) estimates in the length of time that tow was on the bottom, ranging from the period between the winch lockup to winch release to a high standard of acceptance based on the bottom contact sensor tilt angle while the net was on bottom. Table A6 shows the minimum bottom contact time in hours for the same estimates of bottom contact time. The performance of the bottom contact sensor appeared to be more variable in 2002 and bottom contact times may have been lower in 2002 than 2001 when assessed based on the bottom contact sensor data. The information presented in Table A5 is important because it demonstrates that it is difficult to specify minimum tow periods based on the performance of the bottom contact sensor

data. However, there is better comparability when comparing the tow periods based on the more conventional tow duration estimate based on winch lockup to winch release (Table A5).

**Table A5.** Mean bottom contact time for the 2001 and 2002 surveys using three and five estimation methods respectively. Standard: [winch release time]-[winch lockup time]; BCS: [time leave bottom]-[time hit bottom] based on bottom contact sensor; B50, B70 & B80: estimates of total time at tilt angles of 50°, 70° and 80° using the bottom contact sensor for each depth and areal stratum. NA: Not Applicable.

| Depth and | 2002 Survey | | | | | 2001 Survey | | |
|---|---|---|---|---|---|---|---|---|
| areal stratum | Standard | BCS | B50 | B70 | B80 | Standard | B50 | B80 |
| **501-800 m** | | | | | | | | |
| A | 1.13 | 1.10 | 1.09 | 1.06 | 0.79 | 1.03 | 0.96 | 0.81 |
| B | 1.38 | 1.30 | 1.21 | 1.13 | 0.90 | 1.00 | 0.91 | 0.72 |
| C | 1.42 | 1.25 | 1.24 | 1.16 | 0.89 | 1.07 | 1.05 | 0.92 |
| D | 1.35 | 1.29 | 1.18 | 0.98 | 0.70 | 1.20 | 1.08 | 0.93 |
| E | 1.12 | 1.03 | 0.92 | 0.77 | 0.59 | 1.08 | 1.03 | 0.97 |
| F | 0.91 | 0.84 | 0.74 | 0.67 | 0.56 | 1.07 | 0.96 | 0.56 |
| G | 0.90 | 0.86 | 0.71 | 0.56 | 0.46 | NA | NA | NA |
| Average for stratum | 1.19 | 1.12 | 1.04 | 0.93 | 0.72 | 1.07 | 1.00 | 0.82 |
| **801–1200 m** | | | | | | | | |
| A | 1.23 | 1.14 | 1.07 | 0.93 | 0.61 | 1.08 | 0.87 | 0.78 |
| B | 1.21 | 1.05 | 1.01 | 0.87 | 0.56 | 1.16 | 0.99 | 0.74 |
| C | 1.44 | 1.16 | 1.15 | 1.03 | 0.62 | 1.17 | 1.05 | 0.90 |
| D | 1.68 | 1.61 | 1.32 | 0.96 | 0.64 | 1.24 | 1.03 | 0.81 |
| E | 1.29 | 1.23 | 1.03 | 0.92 | 0.53 | 1.14 | 0.94 | 0.81 |
| F | 1.11 | 1.01 | 1.01 | 0.94 | 0.73 | 1.09 | 0.80 | 0.71 |
| G | 1.08 | 0.92 | 0.89 | 0.86 | 0.67 | NA | NA | NA |
| Average for stratum | 1.33 | 1.21 | 1.10 | 0.94 | 0.62 | 1.15 | 0.95 | 0.79 |
| **1201–1600 m** | | | | | | | | |
| A | 1.11 | 0.85 | 0.83 | 0.79 | 0.52 | 1.23 | 0.63 | 0.58 |
| B | 1.35 | 1.17 | 1.16 | 1.15 | 0.73 | 1.33 | 1.46 | 1.45 |
| C | 1.33 | 1.10 | 1.10 | 1.08 | 0.62 | 1.27 | 0.98 | 0.85 |
| D | 1.43 | 1.25 | 1.25 | 1.22 | 0.75 | 1.26 | 1.22 | 1.22 |
| E | 1.15 | 0.71 | 0.59 | 0.37 | 0.09 | 0.97 | 0.84 | 0.82 |
| F | 0.90 | 0.89 | 0.87 | 0.83 | 0.30 | NA | NA | NA |
| G | 1.05 | 0.93 | 0.89 | 0.49 | 0.22 | NA | NA | NA |
| Average for stratum | 1.19 | 1.01 | 0.98 | 0.88 | 0.49 | 1.21 | 1.07 | 1.03 |

12. Table A6 shows the minimum times that were achieved in the two surveys by depth and areal stratum which were used to base the minimum times specified in Table A3. The minima shown in Table A6 should be consulted when deciding whether to accept or reject tows during the 2003 survey.

**Table A6.** Minimum bottom contact time for the 2001 and 2002 surveys using three and five estimation methods respectively. Standard: [winch release time]-[winch lockup time]; BCS: [time leave bottom]-[time hit bottom] based on bottom contact sensor; B50, B70 & B80: estimates of total time at tilt angles of 50°, 70° and 80° using the bottom contact sensor for each depth and areal stratum. NA: Not Applicable.

| Depth and | 2002 Survey | | | | | 2001 Survey | | |
|---|---|---|---|---|---|---|---|---|
| areal stratum | Standard | BCS | B50 | B70 | B80 | Standard | B50 | B80 |
| **501-800 m** | | | | | | | | |
| A | 0.98 | 0.78 | 0.75 | 0.65 | 0.31 | 0.97 | 0.89 | 0.65 |
| B | 1.13 | 0.94 | 0.89 | 0.78 | 0.52 | 1.00 | 0.57 | 0.48 |
| C | 1.20 | 1.05 | 1.05 | 1.04 | 0.70 | 1.00 | 0.91 | 0.65 |
| D | 1.20 | 1.09 | 0.99 | 0.93 | 0.57 | 1.10 | 0.95 | 0.79 |
| E | 0.73 | 0.70 | 0.70 | 0.64 | 0.56 | 0.93 | 0.81 | 0.71 |
| F | 0.88 | 0.77 | 0.50 | 0.41 | 0.32 | 1.00 | 0.85 | 0.43 |
| G | 0.72 | 0.70 | 0.69 | 0.55 | 0.44 | NA | NA | NA |
| Minimum for stratum | 0.72 | 0.70 | 0.50 | 0.41 | 0.31 | 0.93 | 0.57 | 0.43 |
| **801–1200 m** | | | | | | | | |
| A | 1.12 | 0.93 | 0.93 | 0.61 | 0.31 | 1.00 | 0.79 | 0.69 |
| B | 1.03 | 0.86 | 0.85 | 0.83 | 0.46 | 1.00 | 0.56 | 0.38 |
| C | 1.37 | 1.10 | 1.10 | 0.96 | 0.15 | 1.17 | 0.95 | 0.76 |
| D | 1.37 | 1.38 | 1.01 | 0.64 | 0.41 | 1.17 | 0.80 | 0.50 |
| E | 0.93 | 0.97 | 0.80 | 0.67 | 0.18 | 0.93 | 0.80 | 0.46 |
| F | 1.00 | 0.98 | 0.97 | 0.87 | 0.69 | 1.00 | 0.67 | 0.52 |
| G | 1.07 | 0.77 | 0.71 | 0.68 | 0.49 | NA | NA | NA |
| Minimum for stratum | 0.93 | 0.77 | 0.71 | 0.61 | 0.15 | 0.93 | 0.56 | 0.38 |
| **1201–1600 m** | | | | | | | | |
| A | 1.00 | 0.84 | 0.79 | 0.79 | 0.43 | 1.10 | 0.63 | 0.58 |
| B | 1.17 | 1.09 | 1.09 | 1.08 | 0.39 | 1.33 | 1.43 | 1.41 |
| C | 1.20 | 0.91 | 0.91 | 0.89 | 0.46 | 1.10 | 0.82 | 0.72 |
| D | 1.40 | 1.23 | 1.22 | 1.21 | 0.38 | 1.17 | 1.07 | 1.07 |
| E | 1.15 | 0.71 | 0.59 | 0.37 | 0.09 | 0.95 | 0.79 | 0.78 |
| F | 0.55 | 0.55 | 0.55 | 0.53 | 0.15 | NA | NA | NA |
| G | 1.02 | 0.91 | 0.83 | 0.48 | 0.19 | NA | NA | NA |
| Minimum for stratum | 0.55 | 0.55 | 0.55 | 0.37 | 0.09 | 0.95 | 0.63 | 0.58 |

13. The issue of tow duration is important because it is possible that there is a relationship between the length of time spent on the bottom and the CPUE used to estimate the biomass. This relationship is plotted (Figure A2) for the top 12 species in the combined 2001/2002 longspine surveys. Unfortunately, it appears that the species where such a relationship is potentially present is longspine thornyhead, the primary target species of the survey. Because of this plot, it has been decided to maintain the overall tow period (as determined from winch lockup to winch release) in 2003 to the same standards as specified in 2001 and 2002.

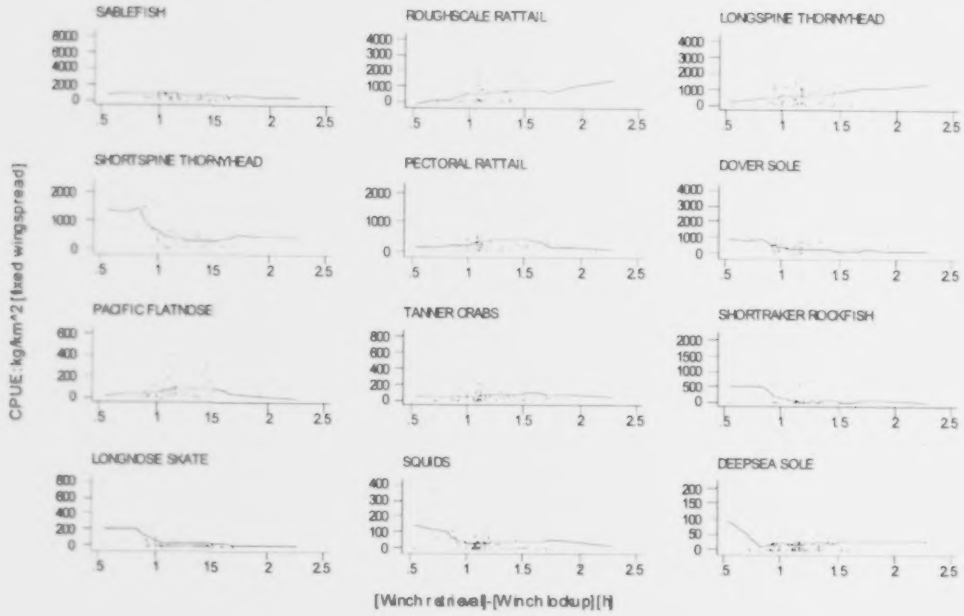


**Figure A2.** CPUE (kg/km$^2$) from the longspine survey (2001 and 2002 surveys combined) plotted against tow duration calculated as the time from winch lockup to winch release for the top 12 species in the survey catch. CPUE={catch_weight/[tow_distance*0.04]} Tow distance is {[winch_release]-[winch_lockup]}*[average_speed]. A lowess line is fitted for each species.

**Protocol for survey and survey gear**

14. This survey is the last of a planned series of three surveys to be conducted in the late summer/early autumn of 2001, 2002 and 2003. It is a requirement of the survey contract that the vessel master is a specialist in the Canadian longspine fishery. The contract is held by the Ocean Selector with skipper Dave Clattenberg.

15. Two nets (#2 box trawl each built to the same agreed specifications) are to be used for the survey and will be retained by the CGRCS for continuity. These nets will have a 50 mm (2 inch) cod end liner made from braided knotless web, Thyboron 107 doors will be used and bridles for the net and a pair of suitable main warp cables will be provided by the vessel. The length of the warp and the weight of the doors are to be measured accurately prior to the beginning of the survey.

16. The survey contract specifies that the net must be restored to its original condition whenever it is mended and that the condition of the net be externally audited at the beginning of each subsequent survey based on a set of written specifications that will be drawn from the original net design.

17. The following net monitoring equipment have been made a condition of the survey contract: a) doorspread monitor; b) pressure depth monitor; c) codend sensor; d) temperature sensor; e) headline height sensor. Two "bottom contact sensors" (one available as a backup) have been manufactured and will be available for use in 2003 which are comparable to those designed by the NMFS and which were loaned for use in the 2001 and 2002 surveys. These devices will give a complete monitoring of the period of contact with the bottom during each tow.

18. The survey is presently scheduled to begin on 03 September and will continue until the 66 tows described in Table A4 are completed. This should take approximately 15-18 days to complete, depending on weather conditions.

**Protocol for selecting and conducting survey tows**

19. Tows will be allocated to 7 areal strata using three depth strata described in Table A4, for a total of 21 separate sub-strata. The depth boundaries will be determined by the mean interpolated depth lines (500 m, 800 m, 1200 m, and 1600 m) based on available bathymetric data (Figure A1). This is to ensure that the strata definitions are continuous. The definitions of these 21 sub-strata are maintained by Rowan Haigh (DFO).

20. Each sub-stratum will be characterized by a set of 500 m X 500 m grids (e.g., Figure A3). There are approximately 33,500 of these grids (or about 8,400 $km^2$; Table A1; Table A7) within the survey area. A list containing a sequence of randomly selected grid co-ordinates from each of the 21 area/depth sub-strata has been provided to the Ocean Selector from which each tow is to be executed until the required number of tows for that sub-stratum is completed. The vessel master is to select a starting location for the tow so that he can pass through the selected grid while maintaining the bottom contact specifications and staying within the boundaries of the sub-stratum. If the location is not suitable (e.g., rough bottom terrain or inappropriate depths for the sub-stratum), then the next randomly selected grid on the list will be sampled.

21. Tows in each sub-stratum will be conducted for about one hour from winch lockup to winch release at a speed of 2.2 nm/h with no more than ±10% variation. The average time period between winch lockup to winch release will be 1.0 hours for the 4 southern strata (Barkley, Loudon/Clayoquot, Clayoquot/Estevan, Nootka/500 Line), with a minimum period of 0.75 hours between winch lockup and winch release. It is assumed that adequate bottom contact will be achieved if these standards are met, but onboard analysis of the bottom contact sensors should be made to confirm that bottom contact time is adequate. The average period between winch lockup to winch release will be relaxed to 0.75 hours and the minimum time to 0.50 hours for the 3 more northerly strata (Esperanza/Kyuquot to Quatsino) because of the more difficult bottom topography in these strata. However, longer bottom contact times in these strata are preferred, if possible.

22. Once a tow location is selected in the 4 southern strata (Barkley, Loudon/Clayoquot, Clayoquot/Estevan, Nootka/500 Line), the skipper is required to tow so that the net passes within 250 m of the designated survey point while maintaining the required minimum bottom contact time (as described in Paragraph 20) and staying within the stratum definition of area and depth range. The requirement to pass within 250 m of the selected random location is relaxed to 2000 m in the three northern strata (Esperanza/Kyuquot; Cape Cook/Winter Harbour and Quatsino), again in acknowledgement of the more difficult bottom topography.

23. An ordered list of 25 randomly selected grid locations will be provided for each of the 21 sub-strata described in Table A4 (7 areal strata X 3 depth strata). The skipper of the *Ocean Selector* will be asked to tow, in any order, the first four locations on the list. However, the skipper is allowed to reject a randomly selected tow location for any of the three reasons listed in Paragraph 24. Additional reasons for discarding random tows can be added if the survey leader (Paul Starr) agrees. However, the list provided in Paragraph 24 are the reasons used in both the 2001 and 2002 surveys and should not be changed substantially in future surveys to ensure comparability with past surveys.

24. Acceptable reasons for discarding a randomly selected tow location and taking the next location:

| | |
|---|---|
| 1. | The bottom topography is not suitable for completing the tow requirements (too rough). |
| 2. | The random grid location does not conform to the sub-stratum definitions (i.e. wrong depth[1] or outside the defined sub-stratum boundaries). |
| 3. | Towing the random grid location means a substantial overlap with a previously selected tow line. The definition of "substantial" is not exact but should be at least 50% same coverage as determined jointly by the skipper and the lead scientist on board. |

[1] Do not accept tows which have more than 5–10% of the total track distance at the wrong depth due to undulating bottom topography, based on a decision jointly made by the skipper and the lead scientist on board the vessel. If the tow track enters a different depth stratum at the end of a tow, it is better to simply end the tow as soon as the depth stratum changes as long as the minimum required tow duration is achieved.

25. The number of tows presented in **Table A4 must all be completed successfully** for each of the 21 sub-strata. The skipper is required to select random grid locations in the order presented in the list described in Paragraph 23 until all tows are completed. Random grid locations can only be skipped if they conform to one of the reasons listed in Paragraph24. If a tow fails the minimum requirements (speed, distance from the grid location, or bottom contact time) described in Paragraphs 21 and 22, then that tow must be discarded and replaced with a tow made through the next random grid location on the list. This procedure is continued until all the required tows for that sub-stratum have been completed.

26. Due to the failure to obtain adequate data streaming software from Scanmar, we will use the screen capture facility provided on the Scanbas system.

    a. The protocol will be to take a screen capture approximately every one minute, resulting in 45 to 70 files for each tow. Screen captures should begin at the time that the winch is locked to ensure that the moment of bottom contact is recorded and should continue until it is clear that the net has left the bottom. This information is saved as a compressed `.bmp` file by the Scanmar software with file sizes of single screen shots on the order of 8-12 kb, and it is probably reasonable to expect that all the screen capture shots for a single tow will fit on a single 1.44 mb floppy. Therefore, the procedure will be to use a fresh floppy for each tow and to transfer all the files to one of the laptops, saving the dump files in a unique subdirectory associated with the tow number. The subdirectories are to be backed up on a CD-R.

    b. We will evaluate whether it is necessary to maintain paper copies of the net monitoring data using the supplemental bridge log. At this point, it is probably not necessary to use the paper forms, given the likely reliability (and timing consuming nature) of the screen dump software. Also, if it appears that the screen dumping procedure is failing at any given moment, then recording on the supplemental bridge logs can be taken up right away to cover for the problem. Therefore, the supplemental bridge logs should be readily available on the bridge so that they can be used in case of failure in the screen dumping procedure.

    c. If it is necessary to use the supplemental bridge logs due to failure of the Scanmar screen dumping procedure, the following protocol is to be used: beginning at the time the net reaches the bottom, at approximately 5 minute intervals, record the vessel direction, speed, depth, position and distance traveled. From the Scanmar system at the same interval, record the headline height, net depth, water velocity at the entrance of the net, doorspread, codend sensor reading, and water temperature at the net. Additionally record the length of warp out, the wind speed and wind direction. Any comments pertaining to the preceding interval can also be

recorded on the form. This procedure should continue until it is clear that the net has left the bottom.

d. The supplemental bridge log form can be used during any tow to record comments by the skipper or any of the voyage scientists, by simply noting the time during the tow. Other information that are not captured in one of the other data streams can also be recorded on these forms.

e. The bottom contact sensor is to be attached to the net footrope and the data are to be downloaded after every tow.

**Table A7.** Approximate number of 500 m X 500 m grids and percentage distribution in each of the 21 depth/area sub-strata presented in Table A4.

| | 501-800 | | 801-1200 | | 1201-1600 | | Total all depths | |
|---|---|---|---|---|---|---|---|---|
| **Longspine Area** | **# Grids** | **% Total** | **# Grids** | **% Total** | **# Grids** | **% Total** | **# Grids** | **% Total** |
| Barkley | 1 965 | 5.9% | 2 756 | 8.2% | 2 351 | 7.0% | 7 072 | 21.1% |
| Loudon/Clayoquot | 1 323 | 3.9% | 1 478 | 4.4% | 2 790 | 8.3% | 5 591 | 16.7% |
| Clayoquot/Estevan | 1 060 | 3.2% | 1 517 | 4.5% | 1 846 | 5.5% | 4 423 | 13.2% |
| Nootka/500 Line | 1 059 | 3.2% | 1 552 | 4.6% | 1 807 | 5.4% | 4 418 | 13.2% |
| Esperanza/Kyuquot | 1 701 | 5.1% | 1 442 | 4.3% | 1 041 | 3.1% | 4 184 | 12.5% |
| Cape Cook/Winter Harbour | 764 | 2.3% | 2 160 | 6.4% | 2 297 | 6.9% | 5 221 | 15.6% |
| Quatsino | 525 | 1.6% | 860 | 2.6% | 1 214 | 3.6% | 2 599 | 7.8% |
| **Total** | 8 397 | 25.1% | 11 765 | 35.1% | 13 346 | 39.8% | 33 508 | 100.0% |

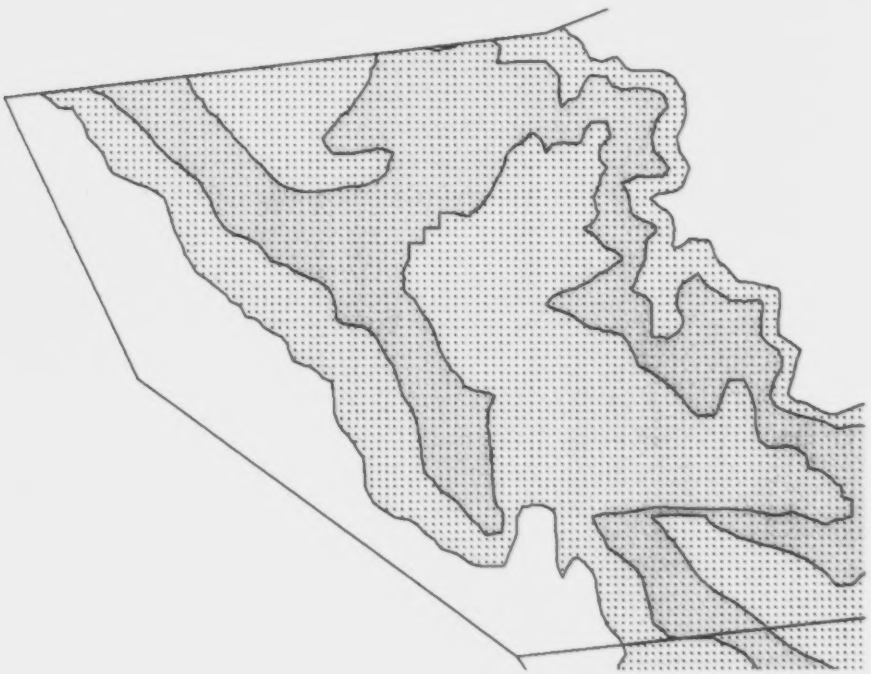

**Figure A3.** Diagram for areal stratum 6 (Cape Cook/Winter Harbour) showing proposed 500 m X 500 m grid locations from which random locations will be selected (each location is represented by a single dot which may not be readily visible in a printed version of this document).

**Provision for untrawlable areas**

27. The set of 500 X 500 m grids was shown in 2001 to Chris Roberts, one of the skippers of the *F/V Viking Storm*, with the request that he indicate areas of known untrawlable bottom. In the end, 26 areas were identified covering about 15% of the available area (about 1,300 $km^2$ – Figure A4). These grids were distributed unevenly among the 6 areal strata fished in 2001, with Nootka/500 Line and Cape Cook/Winter Harbour accounting for over 50% of the excluded grids and Clayoquot/Estevan accounting for less than 3% (Table A8). The percentage of excluded grids was approximately equal among the two shallower depth strata and the deepest stratum accounted for less than 10% of the exclusions, which is probably indicative of the lack of exploration in these depths.

28. The definition of the survey area was not changed in 2002 and will not be changed in 2003 by adding additional excluded grids. This decision has been made to maintain comparability among years.

**Figure A4.** Outlines of the excluded areas (red polygons) in the six areal strata as provided by Chris Roberts from the Viking Storm.

**Table A8.** Distribution of grids excluded in 2001 by depth and area strata expressed as a percentage. Note that the total number of excluded grids is about 15% of the total area of the combined area from Barkley to Cape Cook/Winter Harbour.

| Longspine Area | 501-800 | 801-1200 | 1201-1600 | Total all depths |
|---|---|---|---|---|
| Barkley | 8.5% | 5.7% | 0.0% | 14.1% |
| Loudon/Clayoquot | 8.5% | 3.2% | 0.0% | 11.6% |
| Clayoquot/Estevan | 2.5% | 0.0% | 0.0% | 2.5% |
| Nootka/500 Line | 9.8% | 14.9% | 1.8% | 26.5% |
| Esperanza/Kyuquot | 8.7% | 5.8% | 0.5% | 15.0% |
| Cape Cook/Winter Harbour | 9.9% | 16.0% | 4.4% | 30.3% |
| **Total** | 47.9% | 45.5% | 6.7% | 100.0% |

**Protocol for sampling survey tows**

29. For each tow, the following data will be collected:

    a. Total catch **in numbers** and **weight** for all commercially important or potentially commercially important species of fish (including elasmobranchs). This category will be separated out to the species level. Generally, the total weight in the catch will be determined by successively weighing individual fish bins after sorting.

    b. Total catch in numbers and weight for invertebrate species separated to the Family or Order level will be collected as appropriate. Crabs (queen and tanner) can be separated into species categories.

    c. The following list of species will be sampled for biological characteristics (length, sex and maturity stage). If the catch of that species is too large to sample every fish, then a random sub-sample will be taken for that species. The sub-sample will be weighed to determine the proportion by weight that is sampled of that species.

| Species | Length/sex/maturity sample (every tow) | Otolith sampling | Target number otoliths | Number otoliths to sample per tow |
|---|---|---|---|---|
| Longspine thornyheads | YES | RANDOM AGE | 1000 | 20 |
| Shortspine thornyheads | YES | RANDOM AGE | 600 | 12 |
| Shortraker rockfish | YES | EVERY FISH | 200 | NA |
| Rougheye rockfish | YES | EVERY FISH | 200 | NA |
| Dover sole | YES | RANDOM AGE | 500 | 12 |
| Deepsea sole | YES | NO | N/A | NA |
| Turbot | YES | EVERY FISH | 200 | NA |
| Sablefish | YES | RANDOM AGE | 500 | 12 |
| Roughscale grenadier | YES[1] | RANDOM AGE[2] | N/A | 6 |
| Pectoral grenadier | YES[1] | RANDOM AGE[2] | N/A | 6 |
| Any sharks or skates | YES[1] | NO | N/A | NA |

[1] maturity not required

[2] this sampling will only be undertaken if time permits

    d. Maturity protocols for the appropriate species groupings (flatfish, slope rockfish) will be provided by DFO. There is still no maturity protocol yet developed for the thornyhead species, but the provisional schedule based on information collected during the 2001 and 2002 surveys will be applied again in 2003. The maturity schedule used for longspine and shortspine

thornyheads in these previous surveys was based on a two-stage categorization derived from an email from Bob Lauth of NMFS (Appendix A1).

e. Otoliths will be taken for the indicated finfish species using a random age sampling procedure OR every landed fish, depending on the species. The sampling strategy to be used is described in Paragraph 31. Random otoliths by species will be collected using a random number table that will be supplied by Paul Starr. The number of otoliths taken in any single tow has been determined so that the sampling is spread throughout the entire survey and with the expectation that sampling will not be complete for every tow. Otolith sampling for the grenadier species will have a lower priority and will only be undertaken if it does not take away from the primary survey objectives.

f. The fish selected for otolith sampling in Paragraph 29.c will also be individually weighed to generate a length-weight key.

30. Sampling the catch:

a. The entire catch will be initially sorted by species or invertebrate group. Each category will be then counted and weighed. **Under no circumstances is the total catch to be estimated without being weighed.**

b. If the total catch is large (generally greater than 1000 to 1200 kg), then one of two procedures can be followed to subdivide the catch:

i. One procedure is to place all the fish in bins without sorting. After weighing <u>all</u> the unsorted fish bins, a sufficient number of complete fish bins, totaling approximately 600 to 800 kg in aggregate, will be selected systematically as there may be structure in the way the fish came off the conveyor belt. An example of systematic selection would be to take every second bin (or 2 of every 3 bins). Processing of the selected bins would be done in the usual manner from that point and the sample must be clearly recorded as being a sub-sample of the total catch. It is likely that such a large subsample of the total catch will capture all the species categories in the total catch.

ii. A second procedure is available if it appears that the large catch is comprised of only one or two species. If this is the case, the catch can be sorted in the usual way, with the large species catch set aside (this is most likely to be sablefish or Dover sole). Again, the total catch must be weighed, but the one or two species which dominate the catch can be subsampled while the remainder of the catch is sampled in totality.

iii. In any case, Paul Starr **<u>must</u>** be contacted if this situation occurs and decisions need to be made about how to handle the tow.

c. The conveyer belt of the Ocean Selector should be carefully examined once the catch is sorted and weighed to ensure that fish, particularly smaller size classes, have not been lost in the machinery during the sorting process. If this occurs, a note should be made in the bridge log form or some other suitably location.

d. The entire catch for the species listed in Paragraph 29.c will be measured for length and the sex and maturity state for each fish will be determined. If there are more than 100 to 150 fish

in any category, then that category can be sub-sampled by estimating the total number of fish in the sample and then determining the frequency of selection that would be required to get a sample of approximately 100 fish (e.g. if there are 600 fish, then a sample of 1 in every 6 fish is required). Once this fraction has been determined, then the **entire** catch of that category must be selected using the determined fraction, even if this results in a larger than expected sample size. If the sample size is too small, then the procedure must be repeated using a larger fraction of the catch category.

e. If the catch is bimodal for a particular species (e.g., a large number of small, non-commercial fish and only a few larger commercial-sized fish), then the catch of that species can be sub-divided, with complete enumeration of the less numerous category (usually the large fish category) and sub-sampling of the more numerous category (usually the smaller size classes), as described in Paragraph 30.d. If this occurs, then the total weight of each size category needs to be recorded before sub-sampling (specifying clearly where each sample was obtained) and following this procedure essentially means that two new categories have been created from a single category.

f. The total weight of the sample should be recorded in every instance that a species category is subsampled as described in Paragraph 30.d.

g. If there is time, two or three tows should be subsampled and then fully enumerated for longspine thornyheads to ascertain if the sub-sampling procedures are obtaining reasonable samples of the length distribution. This work will involve measuring every fish in the catch after the catch has been sub-sampled using the procedure outlined in Paragraph 30.d.

31. A random age sampling procedure will be attempted for four species (longspine and shortspine thornyheads, sablefish and Dover sole) in the 2003 survey.

a. The procedure to be followed should be relatively simple and will be based on a set of random numbers generated for each tow. Each list will contain the appropriate number of random numbers (12 or 20), sorted in ascending order and drawn from the appropriate sample size. There will be no duplicate random numbers. See Appendix A2 for an example set of random numbers for four tows across 8 different sample sizes.

b. This procedure will require two individuals, one to sort and one to monitor the random number table. Given that two forms are used for recording biological information and that the preferred form for length frequencies is a tally form that does not lend itself easily to a counting procedure, it will probably be better if the species subsample is counted manually by the sorter, with recorder indicating which fish will put aside for otolith sampling based on the random number table. This will separate the subsample into two bins, one for otolith sampling and the other for simple length frequency measurements. While this procedure will add to the processing time, the additional time should not be onerous. [Alternatively, the counting could be done while sampling for length, if that is easier].

i. This procedure will require the recorder to indicate verbally to the sorter which fish has been selected during the counting process. For instance, if the first number in the random number sequence is "5", then when the fifth fish is counted, it will also become an otolith sample.

ii. It is important for the recorder to not give the sampler prior notice that a fish is due for an otolith sample so that there is no opportunity for bias.

c. As indicated in Paragraph 31.a, there will be two types of random number sheets, one for 20 otolith samples and the other for 12 (which are the two numbers of otolith samples indicated in Paragraph 29.c).

   i. Each sheet will have the correct number of random numbers (12 or 20) drawn from different sample sizes. While a sample size of 100 fish will be common, the number of fish in the sample will vary, depending on the catch. Unless the variation in the sample size in taken into account, the otolith sample will not be complete for the tow if there are fewer fish in the sample than are assumed in the random number list.

   ii. The random numbers for each type will be drawn from decadal samples (e.g. 30, 40, 50, etc. fish) and the decade below the actual sample size can be used to select the otolith samples. For, instance if the sample size is 83 fish, then the random number table appropriate to 80 fish can be used to select the otoliths.

   iii. One sheet for each type (12 or 20 otoliths) will be supplied for each valid survey tow (for a total of 66 tows). Each sheet will have a set of random numbers drawn from a sample of 20 to 100 fish. These sheets of random numbers will be provided by Paul Starr.

## DNA sampling

32. Sampling for DNA will not be undertaken in the 2003 survey.

## Data logging

33. All data will be placed in the existing DFO GFBio database. Current versions of the event, catch and biological sampling forms will be used.

34. All data will be recorded in hard copy. Data checking will be performed after every tow or in the evening as time permits.

## References

Starr, P.J., and Schwarz, C. 2000. Feasibility of a bottom trawl survey for three slope groundfish species in Canadian waters. Can. Stock Assess. Secretariat Res. Doc. 2000/156. Available from http://www.dfo-mpo.gc.ca/csas/csas/English/Research_Years/2000/2000_156E.htm 42 p.

Starr, P.J., Krishka, B.A., and Choromanski, E.M. 2002. Trawl survey for thornyhead biomass estimation off the west coast of Vancouver Island, September 15 - October 2, 2001. Can. Tech. Rep. Fish. Aquat. Sci.: 2421: 60 p.

Starr, P.J., Krishka, B.A., and Choromanski, E.M. *in prep.* Longspine thornyhead random stratified trawl survey off the west coast of Vancouver Island, September 6-23, 2002. 96 p. (Draft document held by Brian Krishka, Pacific Biological Station, Nanaimo BC KrishkaB@pac.dfo-mpo.gc.ca)

Starr, P.J. 2003. Longspine thornyhead random stratified trawl survey, west coast Vancouver Island. 06-23 September 2002. 29 p. (Draft document held by Paul Starr, 1406 Rose Ann Drive, Nanaimo BC paul@starrfish.net)

Wakefield, W.W. 1990. Patterns in the distribution of demersal fishes on the upper continental shelf off central California with studies of ontogenetic vertical migration in particle flux. Ph.D. thesis. University of California, San Diego.

## APPENDIX A1

### TEXT OF EMAIL FROM BOB LAUTH OF THE ALASKA FISHERIES SCIENCE CENTER ON MATURITY STAGES FOR LONGSPINE THORNYHEADS

Maturity for LST's and SST's is a tough one. They do not fit the descriptions of rockfish maturities. So tough in fact that we gave up on it on our slope survey. I believe the only reliable way is using histological means. To begin with, one must be skilled to determine the sex of these fish. I do not believe the NW center even bothers sexing thornyheads on their slope survey. I generally reserve the duty of sexing to a select few who I know have the experience.

The maturity table we have used in the past is a very simple and general one, as follows:

**MALES**
1 IMMATURE - Gonads small, stringlike, and clear or transparent.

2 DEVELOPING OR INACTIVE - Testes swollen, opaque or translucent, colored tan or white. No milt present in ducts or expressible when testis is sectioned.

3 MATURE (ACTIVE) - Testes swollen and opaque. Milt present in ducts posterior to testes.

**FEMALES**
1 IMMATURE - Gonads small, stringlike, and clear or transparent.

2 DEVELOPING OR INACTIVE - Ovary swollen and translucent. No tiny eggs present. (Note: often the outer membrane of ovary must be removed to detect eggs.)

3 MATURE (ACTIVE) - Ovary swollen and translucent or opaque. Tiny eggs present in ovarian tissues.

As you can imagine, this table can be very subjective. Most thornyheads (during the fall) get placed in category 1, regardless that they may have spawned previously. There are a lot of bigger LSTs with small stringlike gonads and a majority of the SSTs under 25 cm are that way. I do not think it is always possible to detect a sexually mature fish during an inactive phase. We rarely see stage 3 males during the fall. Stage 3 females are seen, but different biologists interpret "tiny eggs" differently so the distinction between female stage 2 and 3 is blurred. And, I think there are sexually mature females that have stringlike ovaries in the post-spawning phase that are placed in stage 1 but should actually be place in stage 2.

Perhaps the most useful maturity table would be a 2 scale maturity table: 1) immature – never spawned before 2) sexually mature - spawned before and will spawn again. Trouble is, as stated before, 1) can you reliably sex the fish? and 2) can you reliably use gross examination for determining if these buggers are "sexually mature"? I have concluded that we can do #1 with practice and #2 is a waste of time for your average field biologist.

# APPENDIX A2

EXAMPLE SHEET OF RANDOM NUMBERS FOR OTOLITH SAMPLING
(6 FISH PER TOW FOR 7 TOWS/ NO DUPLICATE NUMBERS)

| Last number | order | set1 | set2 | Set3 | set4 | set5 | set6 | set7 |
|---|---|---|---|---|---|---|---|---|
| 10 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 1 |
| 10 | 2 | 2 | 3 | 2 | 4 | 4 | 3 | 5 |
| 10 | 3 | 4 | 4 | 3 | 5 | 5 | 6 | 6 |
| 10 | 4 | 5 | 5 | 4 | 6 | 6 | 7 | 7 |
| 10 | 5 | 6 | 8 | 5 | 9 | 9 | 8 | 9 |
| 10 | 6 | 8 | 10 | 6 | 10 | 10 | 10 | 10 |
| 20 | 1 | 2 | 2 | 2 | 7 | 1 | 1 | 10 |
| 20 | 2 | 5 | 5 | 4 | 8 | 6 | 6 | 13 |
| 20 | 3 | 10 | 7 | 7 | 10 | 12 | 7 | 15 |
| 20 | 4 | 13 | 11 | 9 | 11 | 17 | 10 | 16 |
| 20 | 5 | 19 | 12 | 12 | 13 | 18 | 16 | 18 |
| 20 | 6 | 20 | 19 | 15 | 14 | 20 | 19 | 20 |
| 30 | 1 | 3 | 3 | 2 | 3 | 11 | 5 | 1 |
| 30 | 2 | 5 | 7 | 7 | 5 | 12 | 18 | 8 |
| 30 | 3 | 8 | 15 | 10 | 11 | 15 | 19 | 10 |
| 30 | 4 | 13 | 19 | 16 | 13 | 16 | 25 | 15 |
| 30 | 5 | 14 | 28 | 18 | 18 | 19 | 26 | 23 |
| 30 | 6 | 24 | 30 | 29 | 22 | 21 | 27 | 28 |
| 40 | 1 | 3 | 4 | 3 | 4 | 14 | 13 | 1 |
| 40 | 2 | 6 | 9 | 9 | 7 | 15 | 16 | 12 |
| 40 | 3 | 11 | 20 | 13 | 14 | 20 | 24 | 23 |
| 40 | 4 | 17 | 26 | 21 | 17 | 21 | 29 | 34 |
| 40 | 5 | 18 | 38 | 24 | 24 | 26 | 30 | 35 |
| 40 | 6 | 32 | 40 | 38 | 29 | 28 | 33 | 39 |
| 50 | 1 | 4 | 5 | 3 | 5 | 18 | 17 | 9 |
| 50 | 2 | 8 | 12 | 11 | 8 | 19 | 20 | 29 |
| 50 | 3 | 13 | 25 | 17 | 17 | 24 | 30 | 32 |
| 50 | 4 | 22 | 32 | 26 | 21 | 27 | 36 | 42 |
| 50 | 5 | 23 | 47 | 29 | 30 | 32 | 37 | 43 |
| 50 | 6 | 40 | 50 | 47 | 37 | 34 | 42 | 45 |
| 60 | 1 | 5 | 6 | 4 | 6 | 21 | 20 | 10 |
| 60 | 2 | 9 | 14 | 13 | 10 | 23 | 24 | 35 |
| 60 | 3 | 16 | 30 | 20 | 21 | 29 | 36 | 38 |
| 60 | 4 | 26 | 38 | 32 | 25 | 32 | 43 | 50 |
| 60 | 5 | 27 | 56 | 35 | 36 | 38 | 44 | 51 |
| 60 | 6 | 48 | 59 | 57 | 44 | 41 | 50 | 54 |
| 70 | 1 | 5 | 30 | 7 | 4 | 7 | 25 | 23 |
| 70 | 2 | 11 | 41 | 16 | 15 | 11 | 26 | 28 |
| 70 | 3 | 18 | 46 | 35 | 23 | 24 | 34 | 41 |
| 70 | 4 | 30 | 50 | 44 | 37 | 29 | 37 | 50 |
| 70 | 5 | 31 | 51 | 66 | 41 | 41 | 45 | 52 |
| 70 | 6 | 55 | 65 | 69 | 66 | 51 | 48 | 58 |
| 80 | 1 | 6 | 35 | 7 | 5 | 8 | 28 | 26 |
| 80 | 2 | 12 | 47 | 18 | 17 | 13 | 30 | 32 |
| 80 | 3 | 21 | 52 | 40 | 26 | 28 | 39 | 47 |
| 80 | 4 | 34 | 57 | 51 | 42 | 33 | 42 | 57 |
| 80 | 5 | 36 | 58 | 75 | 47 | 47 | 51 | 59 |
| 80 | 6 | 63 | 74 | 79 | 75 | 58 | 55 | 66 |

## APPENDIX A2

EXAMPLE SHEET OF RANDOM NUMBERS FOR OTOLITH SAMPLING
(6 FISH PER TOW FOR 7 TOWS/ NO DUPLICATE NUMBERS)

| Last number | order | set1 | set2 | Set3 | set4 | set5 | set6 | set7 |
|---|---|---|---|---|---|---|---|---|
| 10 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 1 |
| 10 | 2 | 2 | 3 | 2 | 4 | 4 | 3 | 5 |
| 10 | 3 | 4 | 4 | 3 | 5 | 5 | 6 | 6 |
| 10 | 4 | 5 | 5 | 4 | 6 | 6 | 7 | 7 |
| 10 | 5 | 6 | 8 | 5 | 9 | 9 | 8 | 9 |
| 10 | 6 | 8 | 10 | 6 | 10 | 10 | 10 | 10 |
| 20 | 1 | 2 | 2 | 2 | 7 | 1 | 1 | 10 |
| 20 | 2 | 5 | 5 | 4 | 8 | 6 | 6 | 13 |
| 20 | 3 | 10 | 7 | 7 | 10 | 12 | 7 | 15 |
| 20 | 4 | 13 | 11 | 9 | 11 | 17 | 10 | 16 |
| 20 | 5 | 19 | 12 | 12 | 13 | 18 | 16 | 18 |
| 20 | 6 | 20 | 19 | 15 | 14 | 20 | 19 | 20 |
| 30 | 1 | 3 | 3 | 2 | 3 | 11 | 5 | 1 |
| 30 | 2 | 5 | 7 | 7 | 5 | 12 | 18 | 8 |
| 30 | 3 | 8 | 15 | 10 | 11 | 15 | 19 | 10 |
| 30 | 4 | 13 | 19 | 16 | 13 | 16 | 25 | 15 |
| 30 | 5 | 14 | 28 | 18 | 18 | 19 | 26 | 23 |
| 30 | 6 | 24 | 30 | 29 | 22 | 21 | 27 | 28 |
| 40 | 1 | 3 | 4 | 3 | 4 | 14 | 13 | 1 |
| 40 | 2 | 6 | 9 | 9 | 7 | 15 | 16 | 12 |
| 40 | 3 | 11 | 20 | 13 | 14 | 20 | 24 | 23 |
| 40 | 4 | 17 | 26 | 21 | 17 | 21 | 29 | 34 |
| 40 | 5 | 18 | 38 | 24 | 24 | 26 | 30 | 35 |
| 40 | 6 | 32 | 40 | 38 | 29 | 28 | 33 | 39 |
| 50 | 1 | 4 | 5 | 3 | 5 | 18 | 17 | 9 |
| 50 | 2 | 8 | 12 | 11 | 8 | 19 | 20 | 29 |
| 50 | 3 | 13 | 25 | 17 | 17 | 24 | 30 | 32 |
| 50 | 4 | 22 | 32 | 26 | 21 | 27 | 36 | 42 |
| 50 | 5 | 23 | 47 | 29 | 30 | 32 | 37 | 43 |
| 50 | 6 | 40 | 50 | 47 | 37 | 34 | 42 | 45 |
| 60 | 1 | 5 | 6 | 4 | 6 | 21 | 20 | 10 |
| 60 | 2 | 9 | 14 | 13 | 10 | 23 | 24 | 35 |
| 60 | 3 | 16 | 30 | 20 | 21 | 29 | 36 | 38 |
| 60 | 4 | 26 | 38 | 32 | 25 | 32 | 43 | 50 |
| 60 | 5 | 27 | 56 | 35 | 36 | 38 | 44 | 51 |
| 60 | 6 | 48 | 59 | 57 | 44 | 41 | 50 | 54 |
| 70 | 1 | 5 | 30 | 7 | 4 | 7 | 25 | 23 |
| 70 | 2 | 11 | 41 | 16 | 15 | 11 | 26 | 28 |
| 70 | 3 | 18 | 46 | 35 | 23 | 24 | 34 | 41 |
| 70 | 4 | 30 | 50 | 44 | 37 | 29 | 37 | 50 |
| 70 | 5 | 31 | 51 | 66 | 41 | 41 | 45 | 52 |
| 70 | 6 | 55 | 65 | 69 | 66 | 51 | 48 | 58 |
| 80 | 1 | 6 | 35 | 7 | 5 | 8 | 28 | 26 |
| 80 | 2 | 12 | 47 | 18 | 17 | 13 | 30 | 32 |
| 80 | 3 | 21 | 52 | 40 | 26 | 28 | 39 | 47 |
| 80 | 4 | 34 | 57 | 51 | 42 | 33 | 42 | 57 |
| 80 | 5 | 36 | 58 | 75 | 47 | 47 | 51 | 59 |
| 80 | 6 | 63 | 74 | 79 | 75 | 58 | 55 | 66 |

## APPENDIX A2 (CONTINUED)

| Last number | order | set1 | set2 | Set3 | set4 | set5 | set6 | set7 |
|---|---|---|---|---|---|---|---|---|
| 90 | 1 | 7 | 8 | 27 | 5 | 9 | 32 | 29 |
| 90 | 2 | 14 | 21 | 53 | 19 | 15 | 34 | 36 |
| 90 | 3 | 23 | 45 | 62 | 30 | 31 | 43 | 53 |
| 90 | 4 | 39 | 57 | 63 | 47 | 37 | 47 | 64 |
| 90 | 5 | 40 | 84 | 67 | 53 | 53 | 57 | 66 |
| 90 | 6 | 71 | 89 | 88 | 85 | 65 | 61 | 75 |
| 100 | 1 | 7 | 9 | 30 | 6 | 10 | 35 | 33 |
| 100 | 2 | 15 | 23 | 59 | 21 | 16 | 37 | 40 |
| 100 | 3 | 26 | 50 | 69 | 33 | 34 | 48 | 59 |
| 100 | 4 | 43 | 63 | 70 | 52 | 41 | 53 | 71 |
| 100 | 5 | 45 | 94 | 74 | 58 | 59 | 63 | 73 |
| 100 | 6 | 79 | 99 | 98 | 94 | 73 | 68 | 83 |
| 110 | 1 | 8 | 10 | 18 | 33 | 6 | 11 | 39 |
| 110 | 2 | 17 | 25 | 19 | 65 | 24 | 18 | 41 |
| 110 | 3 | 28 | 55 | 36 | 76 | 36 | 38 | 53 |
| 110 | 4 | 47 | 69 | 62 | 77 | 57 | 45 | 58 |
| 110 | 5 | 49 | 103 | 63 | 82 | 64 | 65 | 70 |
| 110 | 6 | 87 | 108 | 70 | 108 | 103 | 80 | 75 |
| 120 | 1 | 9 | 11 | 36 | 7 | 11 | 42 | 39 |
| 120 | 2 | 18 | 27 | 71 | 26 | 19 | 45 | 48 |
| 120 | 3 | 31 | 60 | 83 | 39 | 41 | 58 | 71 |
| 120 | 4 | 51 | 76 | 84 | 63 | 49 | 63 | 85 |
| 120 | 5 | 53 | 112 | 89 | 70 | 71 | 76 | 88 |
| 120 | 6 | 95 | 118 | 118 | 113 | 87 | 82 | 99 |

**APPENDIX A2 (CONTINUED)**

| Last number | order | set1 | set2 | Set3 | set4 | set5 | set6 | set7 |
|---|---|---|---|---|---|---|---|---|
| 90 | 1 | 7 | 8 | 27 | 5 | 9 | 32 | 29 |
| 90 | 2 | 14 | 21 | 53 | 19 | 15 | 34 | 36 |
| 90 | 3 | 23 | 45 | 62 | 30 | 31 | 43 | 53 |
| 90 | 4 | 39 | 57 | 63 | 47 | 37 | 47 | 64 |
| 90 | 5 | 40 | 84 | 67 | 53 | 53 | 57 | 66 |
| 90 | 6 | 71 | 89 | 88 | 85 | 65 | 61 | 75 |
| 100 | 1 | 7 | 9 | 30 | 6 | 10 | 35 | 33 |
| 100 | 2 | 15 | 23 | 59 | 21 | 16 | 37 | 40 |
| 100 | 3 | 26 | 50 | 69 | 33 | 34 | 48 | 59 |
| 100 | 4 | 43 | 63 | 70 | 52 | 41 | 53 | 71 |
| 100 | 5 | 45 | 94 | 74 | 58 | 59 | 63 | 73 |
| 100 | 6 | 79 | 99 | 98 | 94 | 73 | 68 | 83 |
| 110 | 1 | 8 | 10 | 18 | 33 | 6 | 11 | 39 |
| 110 | 2 | 17 | 25 | 19 | 65 | 24 | 18 | 41 |
| 110 | 3 | 28 | 55 | 36 | 76 | 36 | 38 | 53 |
| 110 | 4 | 47 | 69 | 62 | 77 | 57 | 45 | 58 |
| 110 | 5 | 49 | 103 | 63 | 82 | 64 | 65 | 70 |
| 110 | 6 | 87 | 108 | 70 | 108 | 103 | 80 | 75 |
| 120 | 1 | 9 | 11 | 36 | 7 | 11 | 42 | 39 |
| 120 | 2 | 18 | 27 | 71 | 26 | 19 | 45 | 48 |
| 120 | 3 | 31 | 60 | 83 | 39 | 41 | 58 | 71 |
| 120 | 4 | 51 | 76 | 84 | 63 | 49 | 63 | 85 |
| 120 | 5 | 53 | 112 | 89 | 70 | 71 | 76 | 88 |
| 120 | 6 | 95 | 118 | 118 | 113 | 87 | 82 | 99 |

**APPENDIX B.** Flatfish gonad condition and maturity stages.

| Maturity Stage | Code | Male (testes) | Female (ovaries) |
|---|---|---|---|
| **Immature** | 1 | very small, string-like and somewhat translucent or pinkish in colour. | very small, translucent or pinkish in colour and somewhat gelatinous in texture. |
| **Maturing** | 2 | enlarged, a distinct bulge evident but still translucent or pinkish in colour. | relatively small, pinkish-yellow or cream in colour, granular in texture. No distinct eggs visible. |
| **Developing** | 3 | enlarged, brown-white or white in colour, firm in texture. | large, cream or yellow in colour, containing opaque eggs that can be distinguished by direct observation. Sex may be determined externally. |
| **Ripe** | 4 | large, white and easily broken. No sperm evident. | containing partly or wholly translucent eggs. Sex easily determined externally. |
| **Spawning** | 5 | large, white and sperm evident. | containing entirely translucent, mature ova. Eggs loose and will run from oviducts under slight pressure. |
| **Spent** | 6 | flaccid, shrunken and yellow-brown in colour. Sperm ducts enlarged and a small amount of sperm may be present. | large, flaccid and purple in colour. A few translucent eggs may be left. Ovarian membrane very bloodshot and sac-like. |
| **Resting** | 7 | firm, small and yellow-brown in colour. Sperm ducts small. | contracted and firm, pinkish-grey to cream-yellow in colour and may appear granular in texture but no distinct eggs are visible. |

**APPENDIX C.** Rockfish (*Sebastes* spp.) gonad condition and maturity stages.

| Maturity Code | Male (testes) | Female (ovaries) |
|---|---|---|
| 0 | **Unknown** | **Unknown** |
| 1 | **Immature** - thread-like and translucent pink in colour. | **Immature** - small, translucent pink in colour. |
| 2 | **Maturing** - string-like, with slight swelling evident but still translucent. | **Maturing** - small, yellow eggs visible. Translucent or opaque. |
| 3 | **Developing** - swelling, brown-white in colour. | **Mature** - large, yellow or orange eggs. Opaque. |
| 4 | **Developed** - large, white and easily broken. | **Fertilized** – large orange-yellow eggs. Translucent. |
| 5 | **Running** – running sperm. | **Embryos or larvae** – include eyed eggs. Translucent. |
| 6 | **Spent** – white-brown in colour. Sperm still present in duct. | **Spent** - large, flaccid, red in colour. A few larvae may be present. |
| 7 | **Resting** - triangular in cross-section. Small and brown in colour. | **Resting** – moderate size, firm, orange-grey in colour. Some with dark blotches. |

**APPENDIX D. Estimating wingspread from wingspread/doorspread paired observations from the 2002 FV *Ocean Selector* longspine survey** (Paul Starr, Canadian Groundfish Research & Conservation Society, 2004)

## Introduction

The 2003 *M.V. Ocean Selector* longspine survey had no wingspread observations because only one Scanmar sensor was available at the time of sailing and this sensor was placed on the doors instead of the wings. Therefore it was necessary to derive a functional relationship which would allow the estimation of wingspread values using the 2003 doorspread observations. Fortunately there were a reasonable number of paired wingspread/doorspread observations from the same vessel when conducting the 2002 longspine survey (Starr et al. 2004).

## Methods

There are 944 records available from the "supplementary bridge logs" which consist of readings of the Scanmar output made from the vessel bridge during each research tow. One hundred eighty-two of these records are missing either a wingspread or a doorspread observation or both. As well, all records from Tow 67 (4 records) were dropped because of suspected transcription errors, leaving a total of 758 valid paired observations (Table D1). A plot of the wingspread/doorspread ratio by set (Figure D1) shows relatively few outliers so it was decided that the data did not require further grooming. A histogram of these ratios (Figure D2) shows that the distribution is underdispersed. It was decided that a normal distribution would be adequate to use for estimating the parameters of the proposed functional relationship.

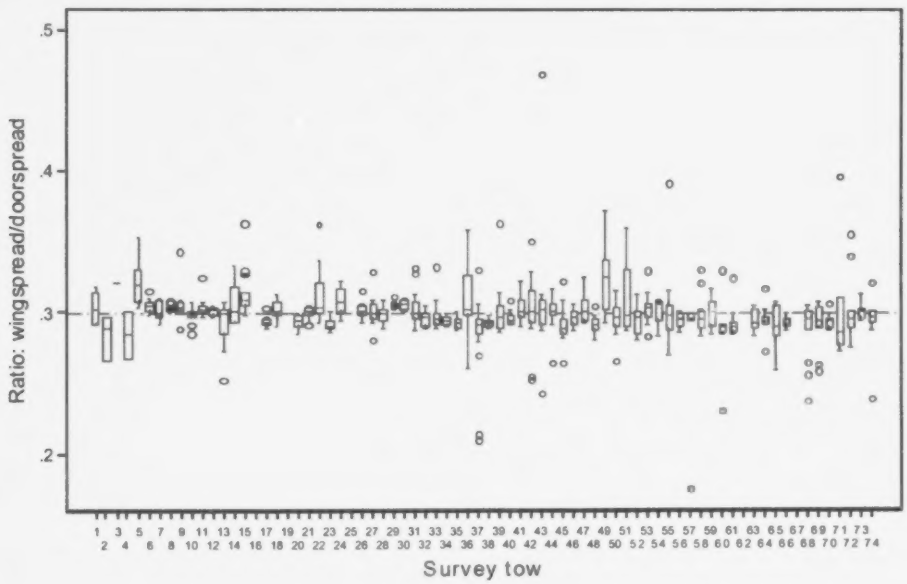


Figure D1. Box plots for each 2002 survey set of the ratio of wingspread to doorspread, showing all outlier points. Heavy horizontal line is the mean of all the ratios for the survey (mean=0.2994).

Table D1. Number of observations, mean, median and other statistics associated with the valid paired observations of wingspread and doorspread from the 2002 longspine survey.

| Variable | N | Mean (m) | Standard Deviation (m) | Median (m) | Minimum (m) | Maximum (m) |
|---|---|---|---|---|---|---|
| Wingspread | 758 | 16.95 | 0.98 | 17.01 | 11.16 | 21.40 |
| Doorspread | 758 | 56.80 | 4.50 | 57.42 | 32.37 | 109.55 |

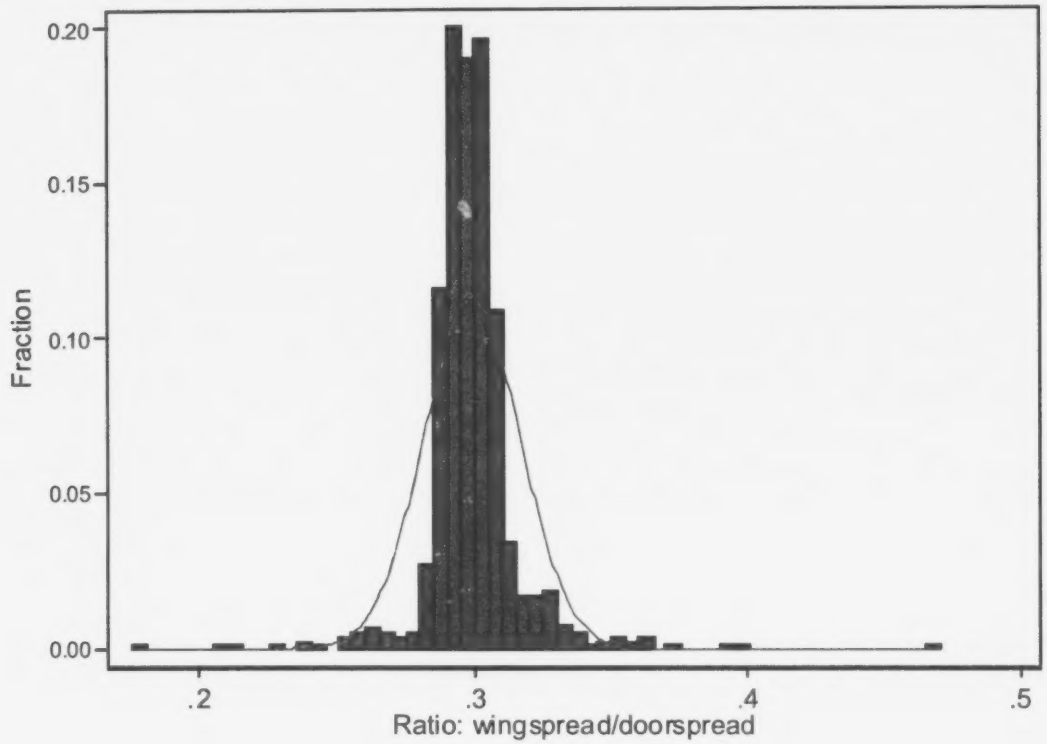


Figure D2. Distribution of the wingspread:doorspread ratio. Also shown is a normal approximation to the distribution.

An asymptotic two parameter exponential model was fitted to these data by minimizing the sum of squares of the deviations from the model in Eq. D1:

$$W_i = \alpha\left(1 - e^{-\upsilon D_i}\right) \qquad \text{Eq. D1}$$

where $\alpha$ and $\upsilon$ are parameters of the model and $W_i$ and $D_i$ are the paired wingspread and doorspread observations in metres. For comparison, two linear regression models were also fitted to the data: a one-parameter model forced through the origin (equivalent to a simple ratio estimator) and a two parameter linear model for comparison with the non-linear model described in Eq. D1.

**Results**

Both of the two-parameter models fit the data well (Figure D3 and Figure D4) but there is a clear preference for the non-linear model given the much better $R^2$ value obtained for that fit (Table D2). This improvement in the fit is probably the result of better residuals for the extreme values in the data set but it is likely that there would little practical difference in the 2003 survey wingspread estimates if either model were used. The simple one-parameter linear model forced through the origin shows a biased pattern in the residuals (Figure D4) and can be rejected on these grounds in spite of its high $R^2$ value (Table D2).

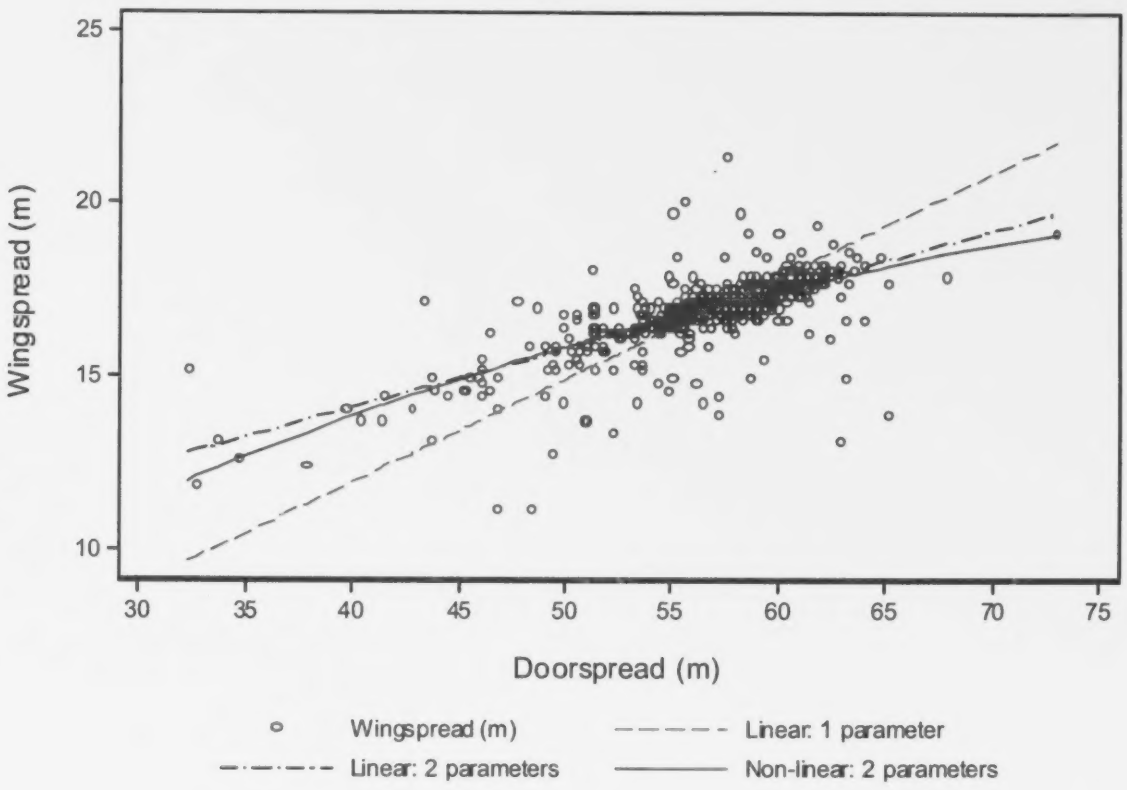


Figure D3. Fit of the three models fitted to the wingspread/doorspread data pairs from the 2002 survey.

Table D2. Estimated parameter values and approximate $R^2$ values for the three fitted models.

| Model | Intercept $\alpha$ | slope $\upsilon$ | Model $R^2$ |
|---|---|---|---|
| Linear: 1 parameter | 0 | 0.298 | 0.9975 |
| Linear: 2 parameters | 7.238 | 0.171 | 0.5168 |
| Nonlinear: 2 parameters | 24.617 | 0.021 | 0.9984 |

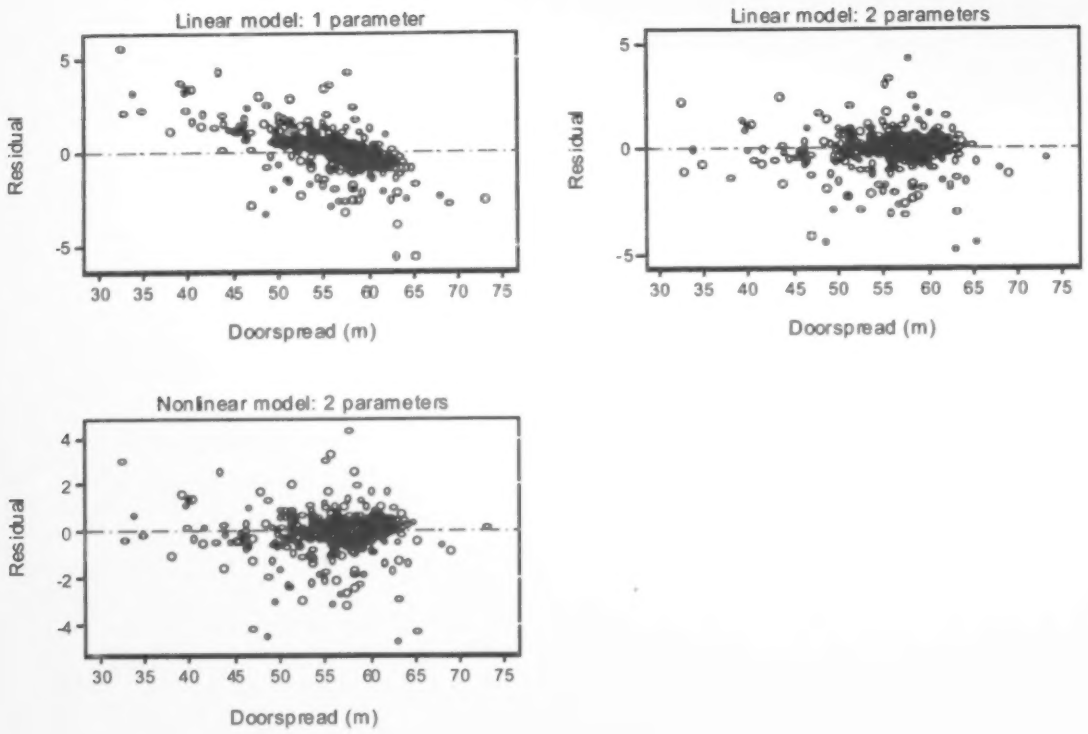


Figure D4. Residuals from the model fit for the three models fitted to the wingspread/doorspread data pairs from the 2002 survey.

## References

Starr, P.J., Krishka, B.A., and Choromanski, E.M. 2004. Longspine thornyhead random stratified trawl survey off the west coast of Vancouver Island, September 6-23, 2002. Can. Tech. Rep. Fish. Aquat. Sci. 2558: 81 p.

**APPENDIX E. Bridge log and haul information by tow for the 2003 Thornyhead Biomass Survey aboard the F/V *Ocean Selector*, September 4-21, 2003. Refer to notes at the end of this appendix to explain data fields. Species catches are sorted in decreasing order within each species group and the total weight of the entire catch is given at the bottom. Trace amounts have no weight shown.**

| Set : | 1 | Date: 05/09/2003 |
|---|---|---|
| Region : | A | Dep Zone: 801-1200 |
| Usable : | yes | Major/Minor : 03 23 |
| Contact (min) : | 63 | Duration (min) : 62 |
| Hdline Hgt (m): | 3.6 | Distance (km) : 4.33 |
| Door sprd (m): | 55.0 | Speed (km/h) : 4.19 |

| | Start | Finish |
|---|---|---|
| Time : | 5:30 | 6:32 |
| Depth (m) : | 997 | 1000 |
| Latitude : | 48° 09.54' | 48° 09.79' |
| Longitude : | 125° 55.46' | 125° 59.89' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 208.4 |
| Shortspine thornyhead | 15.7 |
| **Flatfish** | |
| Dover sole | 2.7 |
| Deepsea sole | 0.9 |
| **Roundfish** | |
| Sablefish | 35.0 |
| **Elasmobranchs** | |
| Roughtail skate | 3.3 |
| **Miscellaneous fish** | |
| Pectoral rattail | 10.3 |
| Roughscale rattail | 6.1 |
| Slickheads | 4.1 |
| Twoline eelpout | 2.0 |
| Black eelpout | 0.6 |
| Pacific flatnose | 0.6 |
| Lumpfishes and snailfishes | |
| Filamented rattail | |
| Northern lampfish | |
| Lanternfishes | |
| **Invertebrates** | |
| Tanner crabs | 0.9 |
| Solasteridae | 0.5 |
| Anemone | 0.5 |
| Tarsaster alascanus | 0.1 |
| Sea urchins | 0.1 |
| **TOTAL** | **291.6 kg** |

| Set : | 2 | Date: 05/09/2003 |
|---|---|---|
| Region : | A | Dep Zone: 1201-1600 |
| Usable : | yes | Major/Minor : 03 23 |
| Contact (min) : | 61 | Duration (min) : 67 |
| Hdline Hgt (m): | 2.6 | Distance (km) : 4.80 |
| Door sprd (m): | 52.3 | Speed (km/h) : 4.30 |

| | Start | Finish |
|---|---|---|
| Time : | 8:03 | 9:10 |
| Depth (m) : | 1253 | 1242 |
| Latitude : | 48° 07.86' | 48° 10.00' |
| Longitude : | 126° 07.04' | 126° 08.38' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 38.4 |
| Shortspine thornyhead | 9.2 |
| **Flatfish** | |
| Deepsea sole | 8.9 |
| **Roundfish** | |
| Sablefish | 9.3 |
| **Elasmobranchs** | |
| Roughtail skate | 3.5 |
| Brown cat shark | 0.5 |
| **Miscellaneous fish** | |
| Pectoral rattail | 210.1 |
| Roughscale rattail | 200.2 |
| Pacific flatnose | 14.4 |
| Twoline eelpout | 3.8 |
| Lumpfishes and snailfishes | 0.7 |
| Deepsea smelts | |
| Lanternfishes | |
| **Invertebrates** | |
| Anemone | 6.3 |
| Octopus | 6.0 |
| Lithodes | 2.2 |
| Tanner crabs | 0.8 |
| Sponges | 0.7 |
| Henricia asthenactis | 0.5 |
| Solasteridae | 0.5 |
| Shrimp | 0.3 |
| Spiny red sea star | |
| Gastropods | |
| Sea cucumber | |
| Schoolmaster gonate squid | |
| **Other items** | |
| Inanimate object(s) | 1.3 |
| **TOTAL** | **517.3 kg** |

| Set : | 3 | Date: 05/09/2003 |
|---|---|---|
| Region : | A | Dep Zone: 801-1200 |
| Usable : | yes | Major/Minor : 03 23 |
| Contact (min) : | 58 | Duration (min) : 63 |
| Hdline Hgt (m): | 4.0 | Distance (km) : 4.68 |
| Door sprd (m): | 49.6 | Speed (km/h) : 4.45 |

| | Start | Finish |
|---|---|---|
| Time : | 11:23 | 12:26 |
| Depth (m) : | 951 | 786 |
| Latitude : | 48° 14.37' | 48° 14.31' |
| Longitude : | 126° 01.63' | 126° 04.98' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 218.0 |
| Shortspine thornyhead | 12.8 |
| **Flatfish** | |
| Deepsea sole | 2.4 |
| Dover sole | 1.1 |
| **Roundfish** | |
| Sablefish | 49.8 |
| **Elasmobranchs** | |
| Roughtail skate | 12.6 |
| **Miscellaneous fish** | |
| Roughscale rattail | 17.1 |
| Pacific flatnose | 2.7 |
| Slickheads | 2.4 |
| Pectoral rattail | 1.7 |
| Twoline eelpout | 0.6 |
| Slender blacksmelt | |
| Lumpfishes and snailfishes | |
| **Invertebrates** | |
| Tanner crabs | 3.0 |
| Sea cucumber | 0.8 |
| Red king crab | 0.8 |
| Jellyfish | 0.7 |
| Heart urchins | 0.2 |
| Henricia asthenactis | 0.0 |
| Spiny red sea star | |
| Glass sponges | |
| Sponges | |
| Lithodes couesi | |
| Solasteridae | |
| Cushion star | |
| Anemone | |
| **TOTAL** | **326.5 kg** |

## Appendix E (continued)

| Set : | 4 | Date: 05/09/2003 |
|---|---|---|
| Region : | A | Dep Zone: 801-1200 |
| **Usable :** | **NO** | Major/Minor : 03 23 |
| Contact (min) : | | Duration (min) : |
| Hdline Hgt (m): | | Distance (km) : |
| Door sprd (m): | | Speed (km/h) : |

| | Start | Finish |
|---|---|---|
| Time : | 13:52 | 14:13 |
| Depth (m) : | 907 | 984 |
| Latitude : | 48° 18.18' | 48° 18.12' |
| Longitude : | 126° 03.57' | 126° 03.89' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 11.1 |
| Shortspine thornyhead | 1.0 |
| **Flatfish** | |
| Dover sole | 1.1 |
| **Roundfish** | |
| Sablefish | 3.8 |
| **Miscellaneous fish** | |
| Slickheads | 1.6 |
| Pectoral rattail | 1.2 |
| Twoline eelpout | 0.8 |
| **Invertebrates** | |
| Tanner crabs | 0.8 |
| Lithodes couesi | 0.8 |
| Octopus | 0.5 |
| Sponges | 0.4 |
| Schoolmaster gonate squid | |
| Paragorgia pacifica | |
| **TOTAL** | **23.0 kg** |

| Set : | 5 | Date: 05/09/2003 |
|---|---|---|
| Region : | A | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 03 23 |
| Contact (min) : | 57 | Duration (min) : 67 |
| Hdline Hgt (m): | 3.5 | Distance (km) : 4.33 |
| Door sprd (m): | 59.4 | Speed (km/h) : 3.88 |

| | Start | Finish |
|---|---|---|
| Time : | 17:27 | 18:34 |
| Depth (m) : | 986 | 1035 |
| Latitude : | 48° 24.92' | 48° 26.14' |
| Longitude : | 126° 21.53' | 126° 24.74' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 61.9 |
| Shortspine thornyhead | 36.1 |
| **Flatfish** | |
| Deepsea sole | 1.1 |
| **Roundfish** | |
| Sablefish | 14.0 |
| **Miscellaneous fish** | |
| Roughscale rattail | 42.9 |
| Pectoral rattail | 20.0 |
| Slickheads | 1.6 |
| Pacific flatnose | 0.8 |
| Lampreys | 0.3 |
| Deepsea smelts | 0.1 |
| Pinpoint lampfish | 0.1 |
| Unknown fish | |
| Slender blacksmelt | |
| Crested bigscale | |
| Popeye | |
| Northern lampfish | |
| **Invertebrates** | |
| Tanner crabs | 6.9 |
| Anemone | 1.9 |
| Spiny red sea star | |
| Schoolmaster gonate squid | |
| Solasteridae | |
| **Other items** | |
| Inanimate object(s) | 0.8 |
| **TOTAL** | **188.3 kg** |

| Set : | 6 | Date: 05/09/2003 |
|---|---|---|
| Region : | A | Dep Zone: 801-1200 |
| **Usable :** | **NO** | Major/Minor : 03 23 |
| Contact (min) : | 83 | Duration (min) : 96 |
| Hdline Hgt (m): | | Distance (km) : |
| Door sprd (m): | 59.9 | Speed (km/h) : 3.51 |

| | Start | Finish |
|---|---|---|
| Time : | 21:44 | 23:20 |
| Depth (m) : | 1134 | 924 |
| Latitude : | 48° 32.90' | 48° 29.94' |
| Longitude : | 126° 21.03' | 126° 20.49' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 80.0 |
| Shortspine thornyhead | 4.5 |
| **Flatfish** | |
| Deepsea sole | 1.6 |
| **Roundfish** | |
| Sablefish | 12.2 |
| **Miscellaneous fish** | |
| Roughscale rattail | 38.1 |
| Pectoral rattail | 8.5 |
| Twoline eelpout | 0.5 |
| Popeye | 0.3 |
| Threadfin slickhead | |
| Slickheads | |
| Lumpfishes and snailfishes | |
| **Invertebrates** | |
| Tanner crabs | 2.2 |
| Octopus | 1.0 |
| Sponges | |
| Jellyfish | |
| Schoolmaster gonate squid | |
| Spiny red sea star | |
| **Other items** | |
| Inanimate object(s) | 0.4 |
| **TOTAL** | **149.3 kg** |

## Appendix E (continued)

| Set : | 7 | Date: 06/09/2003 |
|---|---|---|
| Region : | A | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 03 23 |
| Contact (min) : | 64 | Duration (min) : 74 |
| Hdline Hgt (m): | 3.5 | Distance (km) : 5.38 |
| Door sprd (m): | 59.8 | Speed (km/h) : 4.33 |

| | Start | Finish |
|---|---|---|
| Time : | 6:00 | 7:14 |
| Depth (m) : | 1234 | 1383 |
| Latitude : | 48° 17.68' | 48° 19.97' |
| Longitude : | 126° 16.63' | 126° 18.55' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 55.6 |
| Shortspine thornyhead | 12.1 |
| **Flatfish** | |
| Deepsea sole | 1.2 |
| **Roundfish** | |
| Sablefish | 36.5 |
| **Elasmobranchs** | |
| Abyssal skate | 9.7 |
| Roughtail skate | 9.2 |
| **Miscellaneous fish** | |
| Roughscale rattail | 351.8 |
| Pectoral rattail | 82.3 |
| Pacific flatnose | 28.4 |
| Deepsea smelts | 0.1 |
| Blacktail snailfish | 0.1 |
| Slender blacksmelt | 0.1 |
| **Invertebrates** | |
| Zoantharia | 14.9 |
| Glass sponges | 6.5 |
| Tanner crabs | 5.0 |
| Lithodinae | 2.5 |
| Anemone | 2.0 |
| Lithodes couesi | 0.9 |
| Jellyfish | |
| Solasteridae | |
| Seaslugs | |
| Sea cucumber | |
| **Other items** | |
| Inanimate object(s) | 0.3 |
| **TOTAL** | **619.0 kg** |

| Set : | 8 | Date: 06/09/2003 |
|---|---|---|
| Region : | A | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 03 23 |
| Contact (min) : | 72 | Duration (min) : 69 |
| Hdline Hgt (m): | 3.1 | Distance (km) : 6.50 |
| Door sprd (m): | 58.9 | Speed (km/h) : 5.65 |

| | Start | Finish |
|---|---|---|
| Time : | 8:51 | 10:00 |
| Depth (m) : | 580 | 576 |
| Latitude : | 48° 25.01' | 48° 26.26' |
| Longitude : | 126° 12.29' | 126° 13.65' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 39.3 |
| Longspine thornyhead | 12.2 |
| **Flatfish** | |
| Dover sole | 46.7 |
| **Roundfish** | |
| Sablefish | 522.0 |
| Pacific hake | 9.4 |
| **Elasmobranchs** | |
| Brown cat shark | 0.5 |
| Sandpaper skate | 0.3 |
| **Miscellaneous fish** | |
| Pectoral rattail | 13.2 |
| Roughscale rattail | 9.2 |
| Pacific flatnose | 4.6 |
| Twoline eelpout | 1.3 |
| Eelpouts | 1.1 |
| Filamented rattail | 0.4 |
| Bigeye poacher | |
| **Invertebrates** | |
| Squids | 2.1 |
| Anemone | 1.8 |
| Tanner crabs | 1.7 |
| Solasteridae | |
| **TOTAL** | **665.8 kg** |

| Set : | 9 | Date: 06/09/2003 |
|---|---|---|
| Region : | A | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 03 23 |
| Contact (min) : | 71 | Duration (min) : 64 |
| Hdline Hgt (m): | 2.9 | Distance (km) : 5.26 |
| Door sprd (m): | 52.1 | Speed (km/h) : 4.93 |

| | Start | Finish |
|---|---|---|
| Time : | 11:28 | 12:32 |
| Depth (m) : | 722 | 741 |
| Latitude : | 48° 32.29' | 48° 29.60' |
| Longitude : | 126° 17.70' | 126° 16.73' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 97.6 |
| Shortspine thornyhead | 47.3 |
| Shortraker rockfish | 3.3 |
| **Flatfish** | |
| Dover sole | 14.0 |
| Deepsea sole | 2.0 |
| **Roundfish** | |
| Sablefish | 136.9 |
| Pacific hake | 2.6 |
| **Elasmobranchs** | |
| Longnose skate | 11.8 |
| Brown cat shark | 0.8 |
| **Miscellaneous fish** | |
| Filamented rattail | 2.6 |
| Pectoral rattail | 2.5 |
| Pacific flatnose | 2.4 |
| Twoline eelpout | 1.7 |
| Roughscale rattail | 1.7 |
| Black eelpout | 0.5 |
| Lumpfishes and snailfishes | 0.3 |
| Blacktail snailfish | 0.1 |
| Lanternfishes | |
| Deepsea smelts | |
| **Invertebrates** | |
| Tanner crabs | 25.5 |
| Squids | 3.0 |
| Vampire squid | 1.0 |
| Octopus | 0.9 |
| Anemone | 0.6 |
| Sponges | 0.3 |
| Spiny red sea star | 0.3 |
| Solasteridae | 0.3 |
| Sand star | |
| Myxoderma sacculatum | |
| **TOTAL** | **360.0 kg** |

## Appendix E (continued)

| Set : | 10 | Date: 06/09/2003 |
|---|---|---|
| Region : | A | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 03 23 |
| Contact (min) : | 65 | Duration (min) : 66 |
| Hdline Hgt (m): | 2.9 | Distance (km) : 5.68 |
| Door sprd (m): | 60.7 | Speed (km/h) : 5.16 |

| | Start | Finish |
|---|---|---|
| Time : | 15:25 | 16:31 |
| Depth (m) : | 536 | 576 |
| Latitude : | 48° 28.16' | 48° 30.96' |
| Longitude : | 126° 12.89' | 126° 13.14' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 70.0 |
| Longspine thornyhead | 11.2 |
| Shortraker rockfish | 7.7 |
| **Flatfish** | |
| Dover sole | 60.9 |
| Deepsea sole | 1.8 |
| **Roundfish** | |
| Sablefish | 306.1 |
| Pacific hake | 4.1 |
| **Elasmobranchs** | |
| Longnose skate | 3.8 |
| Sandpaper skate | 1.3 |
| Brown cat shark | 0.5 |
| **Miscellaneous fish** | |
| Pectoral rattail | 3.4 |
| Pacific flatnose | 2.2 |
| Filamented rattail | 2.1 |
| Twoline eelpout | 1.2 |
| Black eelpout | 0.8 |
| **Invertebrates** | |
| Tanner crabs | 15.3 |
| Schoolmaster gonate squid | 8.2 |
| Anemone | 0.5 |
| Fish-eating star | 0.4 |
| Spiny red sea star | 0.2 |
| Solasteridae | 0.2 |
| **TOTAL** | **501.7 kg** |

| Set : | 11 | Date: 06/09/2003 |
|---|---|---|
| Region : | A | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 03 23 |
| Contact (r n) : | 64 | Duration (min) : 68 |
| Hdline Hgt (m): | 3.3 | Distance (km) : 5.23 |
| Door sprd (m): | 60.4 | Speed (km/h) : 4.62 |

| | Start | Finish |
|---|---|---|
| Time : | 17:49 | 18:57 |
| Depth (m) : | 689 | 565 |
| Latitude : | 48° 32.53' | 48° 33.30' |
| Longitude : | 126° 18.02' | 126° 13.85' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 70.1 |
| Longspine thornyhead | 25.9 |
| Shortraker rockfish | 8.8 |
| Rougheye rockfish | 2.6 |
| **Flatfish** | |
| Dover sole | 23.3 |
| Arrowtooth flounder | 2.6 |
| Deepsea sole | 0.2 |
| **Roundfish** | |
| Sablefish | 73.2 |
| Pacific hake | 6.1 |
| **Elasmobranchs** | |
| Longnose skate | 5.0 |
| Brown cat shark | 0.9 |
| **Miscellaneous fish** | |
| Pectoral rattail | 6.3 |
| Twoline eelpout | 1.1 |
| Pacific flatnose | 1.0 |
| Filamented rattail | 0.5 |
| Black eelpout | 0.5 |
| Roughscale rattail | 0.4 |
| Viperfishes | 0.1 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 4.1 |
| Tanner crabs | 2.7 |
| Anemone | 0.8 |
| Sponges | 0.1 |
| **TOTAL** | **236.1 kg** |

| Set : | 12 | Date: 07/09/2003 |
|---|---|---|
| Region : | B | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 63 | Duration (min) : 78 |
| Hdline Hgt (m): | 3.8 | Distance (km) : 4.52 |
| Door sprd (m): | 60.7 | Speed (km/h) : 3.48 |

| | Start | Finish |
|---|---|---|
| Time : | 5:27 | 6:45 |
| Depth (m) : | 1417 | 1527 |
| Latitude : | 48° 37.00' | 48° 34.91' |
| Longitude : | 126° 47.63' | 126° 46.09' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 9.6 |
| Longspine thornyhead | 6.6 |
| **Miscellaneous fish** | |
| Roughscale rattail | 106.9 |
| Pectoral rattail | 78.5 |
| Pacific flatnose | 12.9 |
| Filamented rattail | 1.0 |
| Black eelpout | 0.2 |
| Deepsea smelts | |
| Popeye | |
| Crested bigscale | |
| Blacktail snailfish | |
| **Invertebrates** | |
| Tanner crabs | 7.7 |
| Schoolmaster gonate squid | 4.1 |
| Basket stars | 1.6 |
| Fish-eating star | 0.3 |
| Sea whip | 0.1 |
| Sea cucumber | |
| **Other items** | |
| Inanimate object(s) | 0.1 |
| **TOTAL** | **229.4 kg** |

## Appendix E (continued)

| Set : | 13 | Date: 07/09/2003 |
|---|---|---|
| Region : | B | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 68 | Duration (min) : 78 |
| Hdline Hgt (m): | 3.4 | Distance (km) : 5.17 |
| Door sprd (m): | 60.4 | Speed (km/h) : 3.98 |

| | Start | Finish |
|---|---|---|
| Time : | 8:48 | 10:06 |
| Depth (m) : | 1262 | 1362 |
| Latitude : | 48° 40.45' | 48° 37.89' |
| Longitude : | 126° 53.60' | 126° 52.57' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 22.9 |
| **Roundfish** | |
| Sablefish | 13.7 |
| **Elasmobranchs** | |
| Roughtail skate | 7.8 |
| **Miscellaneous fish** | |
| Roughscale rattail | 645.5 |
| Pectoral rattail | 100.3 |
| Pacific flatnose | 26.5 |
| Filamented rattail | 0.8 |
| Deepsea smelts | 0.1 |
| Crested bigscale | 0.0 |
| **Invertebrates** | |
| Lithodes | 0.6 |
| Eualus | 0.3 |
| **TOTAL** | **818.4 kg** |

| Set : | 14 | Date: 07/09/2003 |
|---|---|---|
| Region : | B | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 66 | Duration (min) : 67 |
| Hdline Hgt (m): | 3.3 | Distance (km) : 5.19 |
| Door sprd (m): | 58.7 | Speed (km/h) : 4.65 |

| | Start | Finish |
|---|---|---|
| Time : | 13:30 | 14:37 |
| Depth (m) : | 850 | 1006 |
| Latitude : | 48° 54.23' | 48° 52.39' |
| Longitude : | 126° 35.27' | 126° 38.37' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 51.0 |
| Shortspine thornyhead | 22.7 |
| **Flatfish** | |
| Dover sole | 16.7 |
| Deepsea sole | 1.1 |
| **Roundfish** | |
| Sablefish | 84.3 |
| **Miscellaneous fish** | |
| Roughscale rattail | 12.4 |
| Pectoral rattail | 0.7 |
| Filamented rattail | 0.4 |
| Twoline eelpout | 0.2 |
| Viperfishes | 0.1 |
| Slickheads | 0.1 |
| Bigeye poacher | 0.1 |
| Popeye | 0.1 |
| Northern lampfish | |
| Blacktail snailfish | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 4.1 |
| Tanner crabs | 1.7 |
| Sponges | |
| Psolidae | |
| Basket stars | |
| Jellyfish | |
| **TOTAL** | **195.6 kg** |

| Set : | 15 | Date: 07/09/2003 |
|---|---|---|
| Region : | B | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 71 | Duration (min) : 73 |
| Hdline Hgt (m): | 3.8 | Distance (km) : 5.74 |
| Door sprd (m): | 57.4 | Speed (km/h) : 4.72 |

| | Start | Finish |
|---|---|---|
| Time : | 16:55 | 18:08 |
| Depth (m) : | 587 | 732 |
| Latitude : | 48° 51.57' | 48° 53.70' |
| Longitude : | 126° 37.06' | 126° 34.07' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 41.6 |
| Longspine thornyhead | 39.9 |
| **Flatfish** | |
| Dover sole | 44.8 |
| Deepsea sole | 0.8 |
| **Roundfish** | |
| Sablefish | 92.9 |
| Pacific hake | 20.6 |
| **Miscellaneous fish** | |
| Pectoral rattail | 16.0 |
| Pacific flatnose | 3.3 |
| Twoline eelpout | 3.1 |
| Black eelpout | 1.1 |
| Blacktail snailfish | 0.7 |
| Northern lampfish | 0.2 |
| Bigeye poacher | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 3.5 |
| Sponges | 3.3 |
| Tanner crabs | 2.2 |
| Solasteridae | |
| Myxoderma sacculatum | |
| **TOTAL** | **274.0 kg** |

## Appendix E (continued)

| Set : | 16 | Date: 07/09/2003 |
|---|---|---|
| Region : | B | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 76 | Duration (min) : 74 |
| Hdline Hgt (m): | 2.9 | Distance (km) : 6.32 |
| Door sprd (m): | 60.5 | Speed (km/h) : 5.13 |

| | Start | Finish |
|---|---|---|
| Time : | 19:54 | 21:08 |
| Depth (m) : | 560 | 552 |
| Latitude : | 48° 46.14' | 48° 43.86' |
| Longitude : | 126° 35.44' | 126° 32.29' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 43.8 |
| Longspine thornyhead | 11.8 |
| Shortraker rockfish | 5.7 |
| **Flatfish** | |
| Dover sole | 75.1 |
| **Roundfish** | |
| Sablefish | 28.0 |
| Pacific hake | 15.7 |
| **Elasmobranchs** | |
| Brown cat shark | 1.0 |
| **Miscellaneous fish** | |
| Pacific flatnose | 5.2 |
| Black eelpout | 3.5 |
| Pectoral rattail | 0.7 |
| Blacktail snailfish | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 13.5 |
| Tanner crabs | 2.1 |
| Anemone | 0.8 |
| Solasteridae | 0.1 |
| Fish-eating star | |
| **Other Items** | |
| Inanimate object(s) | 14.2 |
| **TOTAL** | **221.1 kg** |

| Set : | 17 | Date: 08/09/2003 |
|---|---|---|
| Region : | B | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 61 | Duration (min) : 63 |
| Hdline Hgt (m): | 3.1 | Distance (km) : 4.76 |
| Door sprd (m): | 61.3 | Speed (km/h) : 4.53 |

| | Start | Finish |
|---|---|---|
| Time : | 5:03 | 6:06 |
| Depth (m) : | 633 | 640 |
| Latitude : | 48° 41.93' | 48° 43.27' |
| Longitude : | 126° 29.88' | 126° 33.22' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 24.8 |
| Longspine thornyhead | 10.1 |
| **Flatfish** | |
| Dover sole | 34.0 |
| Deepsea sole | 1.0 |
| **Roundfish** | |
| Sablefish | 34.3 |
| Pacific hake | 9.7 |
| **Miscellaneous fish** | |
| Pectoral rattail | 9.2 |
| Pacific flatnose | 7.2 |
| Black eelpout | 0.6 |
| Filamented rattail | 0.4 |
| Pinpoint lampfish | 0.1 |
| Viperfishes | 0.1 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 5.5 |
| **TOTAL** | **136.9 kg** |

| Set : | 18 | Date: 08/09/2003 |
|---|---|---|
| Region : | B | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 59 | Duration (min) : 63 |
| Hdline Hgt (m): | 3.3 | Distance (km) : 4.83 |
| Door sprd (m): | 59.6 | Speed (km/h) : 4.60 |

| | Start | Finish |
|---|---|---|
| Time : | 7:24 | 8:27 |
| Depth (m) : | 1024 | 896 |
| Latitude : | 48° 39.76' | 48° 41.99' |
| Longitude : | 126° 31.64' | 126° 33.69' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 99.8 |
| Shortspine thornyhead | 43.4 |
| **Roundfish** | |
| Sablefish | 36.4 |
| Pacific hake | 1.7 |
| **Elasmobranchs** | |
| Sandpaper skate | 1.3 |
| **Miscellaneous fish** | |
| Pectoral rattail | 38.4 |
| Roughscale rattail | 13.4 |
| Popeye | 5.1 |
| Pacific flatnose | 5.1 |
| Slickheads | 0.6 |
| Pacific hagfish | 0.4 |
| Twoline eelpout | 0.1 |
| Northern lampfish | 0.1 |
| Viperfishes | 0.1 |
| Deepsea smelts | 0.1 |
| **Invertebrates** | |
| Tanner crabs | 5.1 |
| Schoolmaster gonate squid | 2.1 |
| Anemone | 0.5 |
| **TOTAL** | **253.8 kg** |

## Appendix E (continued)

| Set : | 19 | Date: 08/09/2003 |
|---|---|---|
| Region : | B | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 65 | Duration (min) : 64 |
| Hdline Hgt (m): | 3.3 | Distance (km) : 4.71 |
| Door sprd (m): | 57.1 | Speed (km/h) : 4.41 |

| | Start | Finish |
|---|---|---|
| Time : | 10:27 | 11:31 |
| Depth (m) : | 1072 | 969 |
| Latitude : | 48° 35.45' | 48° 37.88' |
| Longitude : | 126° 30.27' | 126° 28.90' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 95.2 |
| Shortspine thornyhead | 18.7 |
| **Flatfish** | |
| Deepsea sole | 4.4 |
| **Roundfish** | |
| Sablefish | 38.5 |
| **Miscellaneous fish** | |
| Roughscale rattail | 129.8 |
| Pectoral rattail | 29.4 |
| Filamented rattail | 4.9 |
| Twoline eelpout | 1.8 |
| Slickheads | 1.1 |
| Black eelpout | 0.5 |
| Pacific hagfish | 0.4 |
| Pacific flatnose | |
| **Invertebrates** | |
| Tanner crabs | 10.0 |
| Anemone | 3.5 |
| Schoolmaster gonate squid | 1.0 |
| Sponges | 0.6 |
| Fish-eating star | |
| **TOTAL** | **339.8 kg** |

| Set : | 20 | Date: 08/09/2003 |
|---|---|---|
| Region : | B | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 03 23 |
| Contact (min) : | 59 | Duration (min) : 67 |
| Hdline Hgt (m): | 3.4 | Distance (km) : 5.20 |
| Door sprd (m): | 59.8 | Speed (km/h) : 4.66 |

| | Start | Finish |
|---|---|---|
| Time : | 13:32 | 14:39 |
| Depth (m) : | 1170 | 1097 |
| Latitude : | 48° 32.39' | 48° 35.04' |
| Longitude : | 126° 26.36' | 126° 26.15' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 56.4 |
| Shortspine thornyhead | 2.4 |
| **Flatfish** | |
| Deepsea sole | 0.6 |
| **Roundfish** | |
| Sablefish | 19.8 |
| **Elasmobranchs** | |
| Sandpaper skate | 0.2 |
| **Miscellaneous fish** | |
| Roughscale rattail | 111.3 |
| Pectoral rattail | 20.3 |
| Slickheads | 16.0 |
| Filamented rattail | 6.3 |
| Twoline eelpout | 1.9 |
| Pacific flatnose | 0.6 |
| Pacific hagfish | 0.5 |
| Northern lampfish | |
| **Invertebrates** | |
| Tanner crabs | 12.8 |
| Anemone | 1.3 |
| Vampire squid | 0.9 |
| Spiny red sea star | 0.2 |
| Solasteridae | 0.2 |
| Fish-eating star | 0.2 |
| **Other items** | |
| Inanimate object(s) | 0.5 |
| **TOTAL** | **252.6 kg** |

| Set : | 21 | Date: 08/09/2003 |
|---|---|---|
| Region : | B | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 03 23 |
| Contact (min) : | 59 | Duration (min) : 63 |
| Hdline Hgt (m): | 3.3 | Distance (km) : 5.37 |
| Door sprd (m): | 59.1 | Speed (km/h) : 5.11 |

| | Start | Finish |
|---|---|---|
| Time : | 16:02 | 17:05 |
| Depth (m) : | 732 | 691 |
| Latitude : | 48° 37.78' | 48° 39.26' |
| Longitude : | 126° 18.68' | 126° 22.10' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 56.5 |
| Longspine thornyhead | 29.1 |
| **Flatfish** | |
| Dover sole | 52.2 |
| **Roundfish** | |
| Sablefish | 75.7 |
| **Elasmobranchs** | |
| Longnose skate | 7.3 |
| Roughtail skate | 2.3 |
| **Miscellaneous fish** | |
| Roughscale rattail | 26.5 |
| Pectoral rattail | 9.2 |
| Slickheads | 4.9 |
| Filamented rattail | 2.4 |
| Pacific flatnose | 1.8 |
| Twoline eelpout | 1.7 |
| Black eelpout | 0.6 |
| **Invertebrates** | |
| Tanner crabs | 2.2 |
| Schoolmaster gonate squid | 1.2 |
| Octopus | 0.9 |
| Sponges | 0.3 |
| Brittle stars | |
| Sea cucumber | |
| **TOTAL** | **274.6 kg** |

## Appendix E (continued)

| Set : | 22 | Date: 09/09/2003 |
|---|---|---|
| Region : | C | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 66 | Duration (min) : 65 |
| Hdline Hgt (m): | 3.0 | Distance (km) : 5.66 |
| Door sprd (m): | 60.4 | Speed (km/h) : 5.22 |

| | Start | Finish |
|---|---|---|
| Time : | 13:22 | 14:27 |
| Depth (m) : | 677 | 668 |
| Latitude : | 48° 58.25' | 48° 59.91' |
| Longitude : | 126° 49.83' | 126° 53.63' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 13.3 |
| Longspine thornyhead | 10.7 |
| **Flatfish** | |
| Dover sole | 13.8 |
| **Roundfish** | |
| Sablefish | 75.5 |
| **Miscellaneous fish** | |
| Pectoral rattail | 18.1 |
| Black eelpout | 2.6 |
| Pacific flatnose | 1.0 |
| Roughscale rattail | 0.7 |
| Filamented rattail | 0.3 |
| Deepsea smelts | 0.2 |
| Viperfishes | 0.1 |
| Lanternfishes | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 8.4 |
| Tanner crabs | 1.8 |
| Sponges | 1.6 |
| Zoantharia | |
| **Other items** | |
| Inanimate object(s) | 0.4 |
| **TOTAL** | **148.5 kg** |

| Set : | 23 | Date: 09/09/2003 |
|---|---|---|
| Region : | C | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 71 | Duration (min) : 66 |
| Hdline Hgt (m): | 3.1 | Distance (km) : 5.30 |
| Door sprd (m): | 52.5 | Speed (km/h) : 4.82 |

| | Start | Finish |
|---|---|---|
| Time : | 15:52 | 16:58 |
| Depth (m) : | 881 | 860 |
| Latitude : | 48° 57.27' | 48° 59.78' |
| Longitude : | 126° 55.36' | 126° 57.67' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 52.6 |
| Shortspine thornyhead | 11.7 |
| **Flatfish** | |
| Dover sole | 3.5 |
| Deepsea sole | 0.7 |
| **Roundfish** | |
| Sablefish | 33.1 |
| **Elasmobranchs** | |
| Brown cat shark | 2.2 |
| **Miscellaneous fish** | |
| Pectoral rattail | 16.6 |
| Pacific flatnose | 2.2 |
| Roughscale rattail | 1.1 |
| Black eelpout | 0.7 |
| Filamented rattail | 0.5 |
| Blacktail snailfish | 0.2 |
| Lanternfishes | |
| **Invertebrates** | |
| Tanner crabs | 36.3 |
| Schoolmaster gonate squid | 3.0 |
| Sponges | 1.8 |
| Glass sponges | |
| **Other items** | |
| Inanimate object(s) | 0.7 |
| **TOTAL** | **167.1 kg** |

| Set : | 24 | Date: 09/09/2003 |
|---|---|---|
| Region : | C | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 63 | Duration (min) : 64 |
| Hdline Hgt (m): | 3.2 | Distance (km) : 4.56 |
| Door sprd (m): | 60.5 | Speed (km/h) : 4.27 |

| | Start | Finish |
|---|---|---|
| Time : | 18:16 | 19:20 |
| Depth (m) : | 896 | 978 |
| Latitude : | 48° 55.88' | 48° 54.48' |
| Longitude : | 126° 53.78' | 126° 50.47' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 52.9 |
| Shortspine thornyhead | 8.1 |
| **Roundfish** | |
| Sablefish | 7.3 |
| **Elasmobranchs** | |
| Brown cat shark | 0.5 |
| **Miscellaneous fish** | |
| Pectoral rattail | 16.1 |
| Roughscale rattail | 1.5 |
| Filamented rattail | 1.1 |
| Black eelpout | 0.6 |
| Pacific flatnose | 0.3 |
| Slickheads | 0.2 |
| Viperfishes | 0.1 |
| Deepsea smelts | 0.0 |
| **Invertebrates** | |
| Tanner crabs | 32.2 |
| Schoolmaster gonate squid | 0.2 |
| **TOTAL** | **121.0 kg** |

## Appendix E (continued)

| Set : | 25 | Date: 09/09/2003 |
|---|---|---|
| Region : | C | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 65 | Duration (min) : 69 |
| Hdline Hgt (m): | 3.4 | Distance (km) : 5.16 |
| Door sprd (m): | 60.7 | Speed (km/h) : 4.49 |

| | Start | Finish |
|---|---|---|
| Time : | 20:46 | 21:55 |
| Depth (m) : | 1134 | 1112 |
| Latitude : | 48° 53.83' | 48° 56.57' |
| Longitude : | 126° 58.43' | 126° 59.29' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 45.6 |
| Shortspine thornyhead | 12.0 |
| **Flatfish** | |
| Deepsea sole | 0.7 |
| **Roundfish** | |
| Sablefish | 13.2 |
| **Elasmobranchs** | |
| Roughtail skate | 2.3 |
| **Miscellaneous fish** | |
| Roughscale rattail | 130.3 |
| Pectoral rattail | 32.2 |
| Filamented rattail | 12.8 |
| Slickheads | 9.5 |
| Pacific flatnose | 1.2 |
| Deepsea smelts | 0.1 |
| Viperfishes | 0.1 |
| Twoline eelpout | 0.0 |
| **Invertebrates** | |
| Tanner crabs | 14.9 |
| Anemone | 4.9 |
| Glass sponges | 3.0 |
| Lithodes couesi | 1.4 |
| Schoolmaster gonate squid | 0.5 |
| Sponges | |
| **TOTAL** | **284.6 kg** |

| Set : | 26 | Date: 10/09/2003 |
|---|---|---|
| Region : | C | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 03 24 |
| Contact (min) : | 56 | Duration (min) : 69 |
| Hdline Hgt (m): | 3.6 | Distance (km) : 4.42 |
| Door sprd (m): | 62.4 | Speed (km/h) : 3.84 |

| | Start | Finish |
|---|---|---|
| Time : | 0:08 | 1:17 |
| Depth (m) : | 1289 | 1509 |
| Latitude : | 48° 50.98' | 48° 51.86' |
| Longitude : | 126° 56.79' | 127° .12.00' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 18.5 |
| Shortspine thornyhead | 1.9 |
| **Elasmobranchs** | |
| Sandpaper skate | 0.1 |
| **Miscellaneous fish** | |
| Roughscale rattail | 161.3 |
| Pectoral rattail | 70.8 |
| Pacific flatnose | 13.6 |
| Filamented rattail | 5.6 |
| Popeye | 0.2 |
| Twoline eelpout | 0.2 |
| Deepsea smelts | 0.1 |
| **Invertebrates** | |
| Octopus | 3.2 |
| Anemone | 2.4 |
| Fish-eating star | 0.2 |
| Brittle stars | 0.1 |
| **Other items** | |
| Fish eggs | 0.1 |
| **TOTAL** | **278.2 kg** |

| Set : | 27 | Date: 10/09/2003 |
|---|---|---|
| Region : | C | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 72 | Duration (min) : 68 |
| Hdline Hgt (m): | 3.0 | Distance (km) : 5.67 |
| Door sprd (m): | 60.2 | Speed (km/h) : 5.01 |

| | Start | Finish |
|---|---|---|
| Time : | 6:39 | 7:47 |
| Depth (m) : | 567 | 530 |
| Latitude : | 49° 08.96' | 49° 06.45' |
| Longitude : | 127° 01.58' | 126° 59.05' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 64.1 |
| Longspine thornyhead | 3.4 |
| Shortraker rockfish | 2.8 |
| Aurora rockfish | 0.7 |
| **Flatfish** | |
| Dover sole | 215.3 |
| Rex sole | 1.4 |
| **Roundfish** | |
| Sablefish | 142.7 |
| Pacific hake | 10.7 |
| **Elasmobranchs** | |
| Longnose skate | 6.3 |
| **Miscellaneous fish** | |
| Roughscale rattail | 14.5 |
| Pectoral rattail | 12.3 |
| Pacific flatnose | 7.2 |
| Bigfin eelpout | 3.8 |
| Twoline eelpout | 1.7 |
| Filamented rattail | 1.3 |
| Viperfishes | 0.1 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 37.6 |
| Glass sponges | 0.4 |
| Brittle stars | 0.1 |
| **TOTAL** | **526.5 kg** |

## Appendix E (continued)

| Set : | 28 | Date: 10/09/2003 |
|---|---|---|
| Region : | C | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 72 | Duration (min) : 68 |
| Hdline Hgt (m): | 3.1 | Distance (km) : 5.91 |
| Door sprd (m): | 58.7 | Speed (km/h) : 5.21 |

| | Start | Finish |
|---|---|---|
| Time : | 8:44 | 9:52 |
| Depth (m) : | 860 | 841 |
| Latitude : | 49° 07.42' | 49° 09.55' |
| Longitude : | 127° 03.93' | 127° 07.21' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 59.3 |
| Shortspine thornyhead | 30.8 |
| **Flatfish** | |
| Dover sole | 9.6 |
| Deepsea sole | 1.4 |
| **Roundfish** | |
| Sablefish | 52.2 |
| **Elasmobranchs** | |
| Longnose skate | 3.7 |
| Brown cat shark | 2.4 |
| **Miscellaneous fish** | |
| Pectoral rattail | 6.5 |
| Twoline eelpout | 1.3 |
| Roughscale rattail | 1.0 |
| Pacific flatnose | 0.5 |
| Filamented rattail | 0.5 |
| Black eelpout | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 4.3 |
| Tanner crabs | 2.9 |
| Jellyfish | 0.6 |
| **TOTAL** | **176.8 kg** |

| Set : | 29 | Date: 10/09/2003 |
|---|---|---|
| Region : | C | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 69 | Duration (min) : 67 |
| Hdline Hgt (m): | 2.9 | Distance (km) : 5.28 |
| Door sprd (m): | 61.4 | Speed (km/h) : 4.73 |

| | Start | Finish |
|---|---|---|
| Time : | 11:02 | 12:09 |
| Depth (m) : | 631 | 571 |
| Latitude : | 49° 12.38' | 49° 10.32' |
| Longitude : | 127° 06.87' | 127° 04.13' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 45.8 |
| Longspine thornyhead | 5.0 |
| **Flatfish** | |
| Dover sole | 109.3 |
| Deepsea sole | 1.3 |
| **Roundfish** | |
| Sablefish | 348.0 |
| Pacific hake | 14.9 |
| **Elasmobranchs** | |
| Longnose skate | 3.0 |
| Brown cat shark | 0.6 |
| **Miscellaneous fish** | |
| Pectoral rattail | 13.8 |
| Pacific flatnose | 11.0 |
| Black eelpout | 1.3 |
| Roughscale rattail | 1.0 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 27.1 |
| Giant squid | 25.4 |
| Tanner crabs | 7.1 |
| Spiny red sea star | 0.4 |
| Solasteridae | |
| **TOTAL** | **614.9 kg** |

| Set : | 30 | Date: 10/09/2003 |
|---|---|---|
| Region : | C | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 66 | Duration (min) : 68 |
| Hdline Hgt (m): | 2.9 | Distance (km) : 5.52 |
| Door sprd (m): | 61.5 | Speed (km/h) : 4.87 |

| | Start | Finish |
|---|---|---|
| Time : | 13:08 | 14:16 |
| Depth (m) : | 631 | 668 |
| Latitude : | 49° 10.80' | 49° 08.51' |
| Longitude : | 127° 05.89' | 127° 03.09' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 30.5 |
| Longspine thornyhead | 2.7 |
| **Flatfish** | |
| Dover sole | 46.7 |
| **Roundfish** | |
| Sablefish | 119.7 |
| Pacific hake | 4.1 |
| **Elasmobranchs** | |
| Longnose skate | 2.1 |
| Brown cat shark | 0.2 |
| **Miscellaneous fish** | |
| Pectoral rattail | 7.3 |
| Pacific flatnose | 4.8 |
| Black eelpout | 3.2 |
| Twoline eelpout | 0.9 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 38.1 |
| Tanner crabs | 5.1 |
| **TOTAL** | **265.4 kg** |

## Appendix E (continued)

| Set : | 31 | Date: 10/09/2003 |
|---|---|---|
| Region : | C | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 71 | Duration (min) : 88 |
| Hdline Hgt (m): | 4.1 | Distance (km) : 5.12 |
| Door sprd (m): | 58.7 | Speed (km/h) : 3.49 |

| | Start | Finish |
|---|---|---|
| Time : | 16:27 | 17:55 |
| Depth (m) : | 1454 | 1485 |
| Latitude : | 49° 11.03' | 49° 11.06' |
| Longitude : | 127° 16.62' | 127° 12.47' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 2.0 |
| **Elasmobranchs** | |
| Longnose skate | 6.5 |
| Brown cat shark | 0.1 |
| **Miscellaneous fish** | |
| Pectoral rattail | 205.6 |
| Roughscale rattail | 154.9 |
| Pacific flatnose | 24.8 |
| Filamented rattail | 10.8 |
| Twoline eelpout | 2.5 |
| Popeye | 1.8 |
| Lumpfishes and snailfishes | 1.1 |
| Deepsea smelts | 0.4 |
| Northern lampfish | 0.1 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 6.6 |
| Tanner crabs | 3.9 |
| Octopus | 3.6 |
| Vampire squid | 1.7 |
| Shrimp | 0.1 |
| Brittle stars | |
| Sea cucumber | |
| Sea whip | |
| **TOTAL** | **426.4 kg** |

| Set : | 32 | Date: 10/09/2003 |
|---|---|---|
| Region : | D | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 69 | Duration (min) : 85 |
| Hdline Hgt (m): | 4.1 | Distance (km) : 5.94 |
| Door sprd (m): | 57.1 | Speed (km/h) : 4.20 |

| | Start | Finish |
|---|---|---|
| Time : | 19:23 | 20:48 |
| Depth (m) : | 1134 | 988 |
| Latitude : | 49° 17.05' | 49° 19.85' |
| Longitude : | 127° 13.04' | 127° 16.52' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 137.2 |
| Shortspine thornyhead | 11.8 |
| **Flatfish** | |
| Deepsea sole | 3.4 |
| **Roundfish** | |
| Sablefish | 6.8 |
| **Elasmobranchs** | |
| Abyssal skate | 15.3 |
| **Miscellaneous fish** | |
| Roughscale rattail | 146.3 |
| Pectoral rattail | 33.0 |
| Pacific flatnose | 3.8 |
| Filamented rattail | 1.8 |
| Slickheads | 1.2 |
| Popeye | 0.5 |
| Deepsea smelts | 0.1 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 1.7 |
| Tanner crabs | 0.6 |
| Brittle stars | 0.1 |
| **TOTAL** | **363.4 kg** |

| Set : | 33 | Date: 11/09/2003 |
|---|---|---|
| Region : | D | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 65 | Duration (min) : 74 |
| Hdline Hgt (m): | 3.8 | Distance (km) : 4.55 |
| Door sprd (m): | 60.9 | Speed (km/h) : 3.69 |

| | Start | Finish |
|---|---|---|
| Time : | 6:47 | 8:01 |
| Depth (m) : | 1298 | 1390 |
| Latitude : | 49° 19.74' | 49° 17.50' |
| Longitude : | 127° 23.79' | 127° 22.44' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 32.3 |
| **Flatfish** | |
| Deepsea sole | 0.5 |
| **Elasmobranchs** | |
| Pacific sleeper shark | 14.5 |
| **Miscellaneous fish** | |
| Roughscale rattail | 183.4 |
| Pectoral rattail | 60.1 |
| Pacific flatnose | 8.2 |
| Filamented rattail | 4.4 |
| Deepsea smelts | 0.3 |
| Blacktail snailfish | |
| Viperfishes | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 1.4 |
| Anemone | 1.2 |
| Brittle stars | 0.6 |
| Tanner crabs | 0.3 |
| Myxoderma sacculatum | |
| Solasteridae | |
| **TOTAL** | **307.1 kg** |

## Appendix E (continued)

| Set : | 34 | Date: 11/09/2003 |
|---|---|---|
| Region : | D | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 61 | Duration (min) : 63 |
| Hdline Hgt (m): | 3.0 | Distance (km) : 4.85 |
| Door sprd (m): | 61.8 | Speed (km/h) : 4.62 |

| | Start | Finish |
|---|---|---|
| Time : | 10:01 | 11:04 |
| Depth (m) : | 530 | 600 |
| Latitude : | 49° 19.94' | 49° 21.86' |
| Longitude : | 127° 13.56' | 127° 16.34' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 28.7 |
| Shortraker rockfish | 3.9 |
| Longspine thornyhead | 0.5 |
| **Flatfish** | |
| Dover sole | 246.7 |
| Arrowtooth flounder | 15.0 |
| Rex sole | 1.7 |
| **Roundfish** | |
| Sablefish | 207.1 |
| Pacific hake | 8.5 |
| **Elasmobranchs** | |
| Longnose skate | 8.6 |
| Roughtail skate | 5.3 |
| **Miscellaneous fish** | |
| Pectoral rattail | 16.9 |
| Roughscale rattail | 13.6 |
| Black eelpout | 3.0 |
| Pacific flatnose | 2.6 |
| Filamented rattail | 1.4 |
| Blacktail snailfish | 0.4 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 19.8 |
| Tanner crabs | 0.6 |
| Brittle stars | 0.5 |
| Myxoderma sacculatum | |
| **TOTAL** | **584.6 kg** |

| Set : | 35 | Date: 11/09/2003 |
|---|---|---|
| Region : | D | Dep Zone: 801-1200 |
| **Usable :** | **NO** | Major/Minor : 04 25 |
| Contact (min) : | | Duration (min) : |
| Hdline Hgt (m): | | Distance (km) : |
| Door sprd (m): | | Speed (km/h) : |

| | Start | Finish |
|---|---|---|
| Time : | 12:31 | 12:49 |
| Depth (m) : | 860 | 903 |
| Latitude : | 49° 25.42' | 49° 25.14' |
| Longitude : | 127° 17.98' | 127° 19.02' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 39.9 |
| Shortspine thornyhead | 8.0 |
| Shortraker rockfish | 4.5 |
| **Flatfish** | |
| Dover sole | 9.5 |
| Deepsea sole | 7.6 |
| **Roundfish** | |
| Sablefish | 32.8 |
| Pacific hake | 1.5 |
| **Elasmobranchs** | |
| Longnose skate | 8.9 |
| **Miscellaneous fish** | |
| Pectoral rattail | 1.5 |
| Bigfin eelpout | 0.8 |
| Roughscale rattail | 0.8 |
| Barracudinas | 0.7 |
| Slickheads | 0.6 |
| Blacktail snailfish | 0.5 |
| Pacific flatnose | 0.4 |
| Pacific hagfish | 0.4 |
| Filamented rattail | 0.2 |
| Twoline eelpout | 0.1 |
| Black eelpout | 0.1 |
| Lanternfishes | |
| **Invertebrates** | |
| Tanner crabs | 11.6 |
| Schoolmaster gonate squid | 6.0 |
| Solasteridae | 0.6 |
| Brittle stars | 0.3 |
| Glass sponges | |
| **TOTAL** | **137.3 kg** |

| Set : | 36 | Date: 11/09/2003 |
|---|---|---|
| Region : | D | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 70 | Duration (min) : 68 |
| Hdline Hgt (m): | 3.4 | Distance (km) : 5.04 |
| Door sprd (m): | 54.7 | Speed (km/h) : 4.45 |

| | Start | Finish |
|---|---|---|
| Time : | 14:18 | 15:26 |
| Depth (m) : | 812 | 799 |
| Latitude : | 49° 22.23' | 49° 24.70' |
| Longitude : | 127° 18.70' | 127° 19.79' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 84.5 |
| Shortspine thornyhead | 33.9 |
| **Flatfish** | |
| Dover sole | 2.8 |
| Deepsea sole | 1.9 |
| **Roundfish** | |
| Sablefish | 113.1 |
| **Elasmobranchs** | |
| Brown cat shark | 0.8 |
| **Miscellaneous fish** | |
| Pectoral rattail | 23.2 |
| Filamented rattail | 1.1 |
| Bigfin eelpout | 0.4 |
| Slickheads | 0.3 |
| Blacktail snailfish | 0.1 |
| Popeye | 0.1 |
| Twoline eelpout | 0.1 |
| Deepsea smelts | 0.1 |
| **Invertebrates** | |
| Tanner crabs | 18.0 |
| Vampire squid | 4.4 |
| Brittle stars | 0.3 |
| Fish-eating star | 0.1 |
| Solasteridae | 0.1 |
| Jellyfish | |
| Gastropods | |
| Polychaete worms | |
| **TOTAL** | **285.4 kg** |

## Appendix E (continued)

| Set : | 37 | Date: 12/09/2003 |
|---|---|---|
| Region : | G | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 27 |
| Contact (min) : | 57 | Duration (min) : 58 |
| Hdline Hgt (m): | 3.6 | Distance (km) : 4.79 |
| Door sprd (m): | 59.2 | Speed (km/h) : 4.95 |

| | Start | Finish |
|---|---|---|
| Time : | 15:57 | 16:55 |
| Depth (m) : | 549 | 523 |
| Latitude : | 50° 21.99' | 50° 24.53' |
| Longitude : | 128° 29.22' | 128° 29.37' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortraker rockfish | 56.5 |
| Shortspine thornyhead | 54.2 |
| Longspine thornyhead | 10.6 |
| Rougheye rockfish | 8.2 |
| Redbanded rockfish | 0.9 |
| Aurora rockfish | 0.5 |
| **Flatfish** | |
| Dover sole | 87.3 |
| Deepsea sole | 2.0 |
| Rex sole | 1.5 |
| **Roundfish** | |
| Sablefish | 121.4 |
| Pacific hake | 3.4 |
| **Miscellaneous fish** | |
| Filamented rattail | 2.5 |
| Pacific flatnose | 2.2 |
| Black eelpout | 0.9 |
| Popeye | 0.2 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 11.7 |
| Tanner crabs | 3.3 |
| Octopus | 0.9 |
| Jellyfish | |
| Fish-eating star | |
| Gastropods | |
| **TOTAL** | **368.1 kg** |

| Set : | 38 | Date: 12/09/2003 |
|---|---|---|
| Region : | G | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 27 |
| Contact (min) : | 52 | Duration (min) : 56 |
| Hdline Hgt (m): | 3.9 | Distance (km) : 4.73 |
| Door sprd (m): | 59.1 | Speed (km/h) : 5.06 |

| | Start | Finish |
|---|---|---|
| Time : | 19:05 | 20:01 |
| Depth (m) : | 604 | 604 |
| Latitude : | 50° 19.81' | 50° 20.35' |
| Longitude : | 128° 23.58' | 128° 27.26' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortraker rockfish | 75.2 |
| Shortspine thornyhead | 73.6 |
| Longspine thornyhead | 12.8 |
| Rougheye rockfish | 5.5 |
| **Flatfish** | |
| Dover sole | 66.7 |
| Deepsea sole | 3.3 |
| Arrowtooth flounder | 1.7 |
| Rex sole | 0.4 |
| **Roundfish** | |
| Sablefish | 102.0 |
| Pacific hake | 13.4 |
| **Elasmobranchs** | |
| Brown cat shark | 0.5 |
| **Miscellaneous fish** | |
| Pectoral rattail | 5.2 |
| Pacific flatnose | 2.2 |
| Popeye | 0.1 |
| Lumpfishes and snailfishes | |
| Black eelpout | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 19.3 |
| Fish-eating star | |
| **Other Items** | |
| Fish eggs | |
| **TOTAL** | **382.0 kg** |

| Set : | 39 | Date: 12/09/2003 |
|---|---|---|
| Region : | G | Dep Zone: 801-1200 |
| **Usable :** | **NO** | Major/Minor : 04 27 |
| Contact (min) : | | Duration (min) : |
| Hdline Hgt (m): | | Distance (km) : |
| Door sprd (m): | | Speed (km/h) : |

| | Start | Finish |
|---|---|---|
| Time : | 21:28 | 22:20 |
| Depth (m) : | 794 | 1174 |
| Latitude : | 50° 19.28' | 50° 17.51' |
| Longitude : | 128° 22.17' | 128° 23.85' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 45.7 |
| Shortspine thornyhead | 35.2 |
| Shortraker rockfish | 31.7 |
| **Flatfish** | |
| Dover sole | 102.1 |
| Deepsea sole | 1.4 |
| **Roundfish** | |
| Sablefish | 197.6 |
| Pacific hake | 4.0 |
| **Elasmobranchs** | |
| Roughtail skate | 7.2 |
| Brown cat shark | 0.6 |
| **Miscellaneous fish** | |
| Pectoral rattail | 15.6 |
| Roughscale rattail | 2.1 |
| Filamented rattail | 2.0 |
| Pacific hagfish | 0.9 |
| Pacific flatnose | 0.7 |
| Black eelpout | 0.6 |
| Twoline eelpout | 0.6 |
| Blackfin poacher | |
| **Invertebrates** | |
| Tanner crabs | 4.2 |
| Schoolmaster gonate squid | 3.5 |
| Solasteridae | 1.4 |
| Spiny red sea star | 0.4 |
| Gastropods | |
| Anemone | |
| **TOTAL** | **457.4 kg** |

## Appendix E (continued)

| Set : | 40 | Date: 13/09/2003 |
|---|---|---|
| Region : | G | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 27 |
| Contact (min) : | 58 | Duration (min) : 52 |
| Hdline Hgt (m): | 3.0 | Distance (km) : 4.09 |
| Door sprd (m): | 59.9 | Speed (km/h) : 4.71 |

| | Start | Finish |
|---|---|---|
| Time : | 5:33 | 6:25 |
| Depth (m) : | 969 | 1198 |
| Latitude : | 50° 19.15' | 50° 17.25' |
| Longitude : | 128° 22.36' | 128° 24.04' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 92.4 |
| Shortspine thornyhead | 44.8 |
| **Flatfish** | |
| Dover sole | 88.3 |
| Deepsea sole | 4.6 |
| **Roundfish** | |
| Sablefish | 155.1 |
| **Elasmobranchs** | |
| Roughtail skate | 5.1 |
| **Miscellaneous fish** | |
| Pectoral rattail | 42.4 |
| Popeye | 32.8 |
| Roughscale rattail | 17.8 |
| Filamented rattail | 12.8 |
| Twoline eelpout | 1.9 |
| Pacific flatnose | 1.6 |
| Pacific hagfish | 0.6 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 5.9 |
| Tanner crabs | 3.5 |
| Solasteridae | 1.7 |
| Anemone | 0.7 |
| Octopus | 0.4 |
| Sea cucumber | 0.2 |
| **TOTAL** | **512.6 kg** |

| Set : | 41 | Date: 13/09/2003 |
|---|---|---|
| Region : | G | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 27 |
| Contact (min) : | 52 | Duration (min) : 54 |
| Hdline Hgt (m): | 3.6 | Distance (km) : 4.15 |
| Door sprd (m): | 60.9 | Speed (km/h) : 4.61 |

| | Start | Finish |
|---|---|---|
| Time : | 7:32 | 8:26 |
| Depth (m) : | 1097 | 951 |
| Latitude : | 50° 17.17' | 50° 19.24' |
| Longitude : | 128° 23.57' | 128° 22.29' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 43.6 |
| Shortspine thornyhead | 26.8 |
| **Flatfish** | |
| Dover sole | 26.6 |
| Deepsea sole | 3.8 |
| **Roundfish** | |
| Sablefish | 53.5 |
| **Elasmobranchs** | |
| Roughtail skate | 10.5 |
| **Miscellaneous fish** | |
| Roughscale rattail | 319.0 |
| Pectoral rattail | 29.1 |
| Popeye | 28.8 |
| Pacific flatnose | 3.2 |
| Filamented rattail | 1.4 |
| Twoline eelpout | 0.6 |
| Blacktail snailfish | 0.3 |
| **Invertebrates** | |
| Solasteridae | 1.3 |
| Tanner crabs | 1.2 |
| Sea cucumber | 0.5 |
| Anemone | 0.4 |
| Spiny red sea star | 0.2 |
| Gastropods | |
| Zoantharia | |
| **Other Items** | |
| Inanimate object(s) | 3.0 |
| **TOTAL** | **553.7 kg** |

| Set : | 42 | Date: 13/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 27 |
| Contact (min) : | 60 | Duration (min) : 59 |
| Hdline Hgt (m): | 3.4 | Distance (km) : 4.47 |
| Door sprd (m): | 60.8 | Speed (km/h) : 4.54 |

| | Start | Finish |
|---|---|---|
| Time : | 10:39 | 11:38 |
| Depth (m) : | 860 | 1006 |
| Latitude : | 50° 15.76' | 50° 14.43' |
| Longitude : | 128° 21.97' | 128° 25.00' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 259.6 |
| Longspine thornyhead | 66.9 |
| **Flatfish** | |
| Dover sole | 106.3 |
| Deepsea sole | 1.3 |
| **Roundfish** | |
| Sablefish | 267.8 |
| **Elasmobranchs** | |
| Roughtail skate | 2.6 |
| **Miscellaneous fish** | |
| Roughscale rattail | 45.2 |
| Pectoral rattail | 33.5 |
| Popeye | 9.1 |
| Pacific flatnose | 1.2 |
| Viperfishes | 0.5 |
| Slickheads | 0.5 |
| Filamented rattail | 0.5 |
| Northern lampfish | |
| **Invertebrates** | |
| Tanner crabs | 6.3 |
| Schoolmaster gonate squid | 4.0 |
| Spiny red sea star | 1.5 |
| Octopus | 1.3 |
| Glass sponges | 0.6 |
| Lithodes couesi | 0.5 |
| Sponges | 0.2 |
| Solasteridae | |
| Psolidae | |
| **TOTAL** | **809.3 kg** |

## Appendix E (continued)

| Set : | 43 | Date: 14/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 801-1200 |
| Usable : | yes | Major/Minor : 04 27 |
| Contact (min) : | 57 | Duration (min) : 54 |
| Hdline Hgt (m): | 3.7 | Distance (km) : 3.61 |
| Door sprd (m): | 58.8 | Speed (km/h) : 4.01 |

| | Start | Finish |
|---|---|---|
| Time : | 6:40 | 7:34 |
| Depth (m) : | 1079 | 1125 |
| Latitude : | 50° 14.32' | 50° 13.18' |
| Longitude : | 128° 19.24' | 128° 21.65' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 177.1 |
| Shortspine thornyhead | 14.7 |
| **Flatfish** | |
| Dover sole | 17.1 |
| Deepsea sole | 9.6 |
| **Roundfish** | |
| Sablefish | 195.1 |
| **Elasmobranchs** | |
| Abyssal skate | 1.9 |
| **Miscellaneous fish** | |
| Pectoral rattail | 51.9 |
| Roughscale rattail | 31.7 |
| Popeye | 10.8 |
| Filamented rattail | 8.2 |
| Twoline eelpout | 4.8 |
| Pacific flatnose | 3.2 |
| Pacific hagfish | 0.5 |
| Slickheads | 0.3 |
| Deepsea smelts | |
| **Invertebrates** | |
| Anemone | 6.1 |
| Spiny red sea star | 1.7 |
| Tanner crabs | 0.7 |
| Brittle stars | 0.1 |
| Jellyfish | |
| **TOTAL** | **535.5 kg** |

| Set : | 44 | Date: 14/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 801-1200 |
| Usable : | yes | Major/Minor : 04 27 |
| Contact (min) : | 55 | Duration (min) : 51 |
| Hdline Hgt (m): | 3.6 | Distance (km) : 3.79 |
| Door sprd (m): | 56.1 | Speed (km/h) : 4.46 |

| | Start | Finish |
|---|---|---|
| Time : | 10:20 | 11:11 |
| Depth (m) : | 1070 | 1061 |
| Latitude : | 50° 10.96' | 50° 12.66' |
| Longitude : | 128° 24.67' | 128° 22.87' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 90.3 |
| Shortspine thornyhead | 11.1 |
| **Roundfish** | |
| Sablefish | 83.7 |
| **Elasmobranchs** | |
| Abyssal skate | 2.6 |
| Sandpaper skate | 0.7 |
| **Miscellaneous fish** | |
| Roughscale rattail | 133.6 |
| Pectoral rattail | 22.4 |
| Popeye | 6.1 |
| Filamented rattail | 4.0 |
| Pacific flatnose | 3.1 |
| Bigfin eelpout | |
| **Invertebrates** | |
| Tanner crabs | 13.0 |
| Anemone | 4.0 |
| Glass sponges | 2.7 |
| Solasteridae | 0.8 |
| Spiny red sea star | 0.5 |
| Brittle stars | 0.1 |
| Gastropods | |
| Lithodes couesi | |
| Zoantharia | |
| **TOTAL** | **378.8 kg** |

| Set : | 45 | Date: 14/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 1201-1600 |
| Usable : | NO | Major/Minor : 04 27 |
| Contact (min) : | | Duration (min) : |
| Hdline Hgt (m): | | Distance (km) : |
| Door sprd (m): | | Speed (km/h) : |

| | Start | Finish |
|---|---|---|
| Time : | 13:13 | |
| Depth (m) : | 1372 | |
| Latitude : | 50° 15.24' | 50° 15.16' |
| Longitude : | 128° 28.11' | 128° 28.93' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 0.7 |
| **Flatfish** | |
| Deepsea sole | 1.4 |
| **Roundfish** | |
| Sablefish | 2.0 |
| **Elasmobranchs** | |
| Abyssal skate | 5.3 |
| Sandpaper skate | 0.2 |
| **Miscellaneous fish** | |
| Roughscale rattail | 11.5 |
| Pectoral rattail | 0.9 |
| Popeye | 0.5 |
| **Invertebrates** | |
| Sponges | 3.1 |
| Vampire squid | 0.7 |
| Sea cucumber | 0.2 |
| Zoantharia | |
| **TOTAL** | **26.5 kg** |

## Appendix E (continued)

| Set : | 46 | Date: 14/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 04 27 |
| Contact (min) : | 51 | Duration (min) : 57 |
| Hdline Hgt (m): | 3.9 | Distance (km) : 3.40 |
| Door sprd (m): | 62.4 | Speed (km/h) : 3.58 |

| | Start | Finish |
|---|---|---|
| Time : | 14:58 | 15:55 |
| Depth (m) : | 1372 | 1317 |
| Latitude : | 50° 15.41' | 50° 15.05' |
| Longitude : | 128° 28.35' | 128° 31.07' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 7.8 |
| Shortspine thornyhead | 6.3 |
| **Flatfish** | |
| Deepsea sole | 9.2 |
| **Roundfish** | |
| Sablefish | 4.4 |
| **Elasmobranchs** | |
| Abyssal skate | 3.1 |
| **Miscellaneous fish** | |
| Roughscale rattail | 101.8 |
| Pectoral rattail | 21.6 |
| Popeye | 20.3 |
| Pacific flatnose | 9.4 |
| Filamented rattail | 2.5 |
| Blacktail snailfish | 0.1 |
| **Invertebrates** | |
| Echinasteridae | 5.9 |
| Paragorgia pacifica | 1.9 |
| Jellyfish | 0.6 |
| Sand star | |
| Brittle stars | |
| **TOTAL** | **194.6 kg** |

| Set : | 47 | Date: 14/09/2003 |
|---|---|---|
| Region : | G | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 04 27 |
| Contact (min) : | 60 | Duration (min) : 67 |
| Hdline Hgt (m): | 5.1 | Distance (km) : 4.38 |
| Door sprd (m): | 62.1 | Speed (km/h) : 3.92 |

| | Start | Finish |
|---|---|---|
| Time : | 18:13 | 19:20 |
| Depth (m) : | 1244 | 1253 |
| Latitude : | 50° 16.57' | 50° 17.15' |
| Longitude : | 128° 37.42' | 128° 40.90' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 19.9 |
| Shortspine thornyhead | 6.3 |
| **Flatfish** | |
| Deepsea sole | 0.7 |
| **Elasmobranchs** | |
| Abyssal skate | 19.2 |
| **Miscellaneous fish** | |
| Roughscale rattail | 183.8 |
| Pectoral rattail | 104.4 |
| Pacific flatnose | 18.2 |
| Popeye | 3.8 |
| Filamented rattail | 2.0 |
| Deepsea smelts | 0.2 |
| **Invertebrates** | |
| Echinasteridae | 2.1 |
| Vampire squid | 1.7 |
| Schoolmaster gonate squid | 0.2 |
| Solasteridae | 0.2 |
| Brittle stars | |
| **TOTAL** | **362.9 kg** |

| Set : | 48 | Date: 14/09/2003 |
|---|---|---|
| Region : | G | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 04 27 |
| Contact (min) : | 53 | Duration (min) : 53 |
| Hdline Hgt (m): | 3.8 | Distance (km) : 3.33 |
| Door sprd (m): | 52.1 | Speed (km/h) : 3.77 |

| | Start | Finish |
|---|---|---|
| Time : | 22:46 | 23:39 |
| Depth (m) : | 1262 | 1280 |
| Latitude : | 50° 15.95' | 50° 17.42' |
| Longitude : | 128° 42.09' | 128° 43.63' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 57.2 |
| Shortspine thornyhead | 4.9 |
| **Flatfish** | |
| Deepsea sole | 3.3 |
| **Elasmobranchs** | |
| Abyssal skate | 11.1 |
| Roughtail skate | 0.6 |
| **Miscellaneous fish** | |
| Roughscale rattail | 149.1 |
| Pectoral rattail | 68.5 |
| Pacific flatnose | 14.4 |
| Giant blobsculpin | 4.4 |
| Filamented rattail | 1.9 |
| Deepsea smelts | 0.1 |
| Northern lampfish | |
| **Invertebrates** | |
| Vampire squid | 4.1 |
| Anemone | 2.0 |
| Tanner crabs | 0.6 |
| Schoolmaster gonate squid | 0.3 |
| Sand star | |
| Gastropods | |
| Brittle stars | |
| Zoantharia | |
| **Other items** | |
| Inanimate object(s) | 3.3 |
| **TOTAL** | **325.8 kg** |

## Appendix E (continued)

| Set : | 49 | Date: 15/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 801-1200 |
| Usable : | yes | Major/Minor : 04 27 |
| Contact (min) : | 48 | Duration (min) : 51 |
| Hdline Hgt (m): | 3.0 | Distance (km) : 3.97 |
| Door sprd (m): | 61.1 | Speed (km/h) : 4.66 |

| | Start | Finish |
|---|---|---|
| Time : | 6:39 | 7:30 |
| Depth (m) : | 863 | 1061 |
| Latitude : | 50° 13.17' | 50° 11.70' |
| Longitude : | 128° 35.99' | 128° 33.56' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 52.6 |
| Shortspine thornyhead | 12.3 |
| **Flatfish** | |
| Deepsea sole | 0.7 |
| **Roundfish** | |
| Sablefish | 12.6 |
| **Elasmobranchs** | |
| Roughtail skate | 2.4 |
| Sandpaper skate | 2.2 |
| **Miscellaneous fish** | |
| Roughscale rattail | 6.9 |
| Pectoral rattail | 5.0 |
| Filamented rattail | 0.9 |
| Pacific flatnose | 0.7 |
| Eelpouts | 0.1 |
| Northern lampfish | 0.1 |
| Deepsea smelts | 0.1 |
| **Invertebrates** | |
| Glass sponges | 12.8 |
| Brittle stars | 1.3 |
| Lithodes couesi | 1.1 |
| Octopus | 0.9 |
| Solasteridae | 0.2 |
| Anemone | 0.2 |
| **Other items** | |
| Inanimate object(s) | 2.3 |
| **TOTAL** | **115.4 kg** |

| Set : | 50 | Date: 15/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 1201-1600 |
| Usable : | yes | Major/Minor : 04 27 |
| Contact (min) : | 48 | Duration (min) : 62 |
| Hdline Hgt (m): | 4.0 | Distance (km) : 4.49 |
| Door sprd (m): | 60.4 | Speed (km/h) : 4.35 |

| | Start | Finish |
|---|---|---|
| Time : | 8:55 | 9:57 |
| Depth (m) : | 1335 | 1308 |
| Latitude : | 50° 08.29' | 50° 06.68' |
| Longitude : | 128° 30.73' | 128° 28.52' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 11.6 |
| Shortspine thornyhead | 7.5 |
| **Flatfish** | |
| Deepsea sole | 0.8 |
| **Miscellaneous fish** | |
| Roughscale rattail | 101.0 |
| Pectoral rattail | 86.9 |
| Pacific flatnose | 18.1 |
| Popeye | 3.7 |
| Filamented rattail | 1.4 |
| Deepsea smelts | |
| Viperfishes | |
| Lumpfishes and snailfishes | |
| Crested bigscale | |
| **Invertebrates** | |
| Glass sponges | 1.9 |
| Shrimp | 0.5 |
| Echinasteridae | 0.5 |
| Schoolmaster gonate squid | 0.2 |
| Golden king crab | |
| Sand star | |
| Solasteridae | |
| Brittle stars | |
| Zoantharia | |
| **Other items** | |
| Inanimate object(s) | 0.7 |
| **TOTAL** | **234.7 kg** |

| Set : | 51 | Date: 15/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 501-800 |
| Usable : | yes | Major/Minor : 04 26 |
| Contact (min) : | 71 | Duration (min) : 71 |
| Hdline Hgt (m): | 4.4 | Distance (km) : 5.60 |
| Door sprd (m): | 52.8 | Speed (km/h) : |

| | Start | Finish |
|---|---|---|
| Time : | 12:51 | 14:02 |
| Depth (m) : | 604 | 786 |
| Latitude : | 49° 56.42' | 49° 58.71' |
| Longitude : | 128° 05.00' | 128° 07.96' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 166.9 |
| Longspine thornyhead | 98.4 |
| Shortraker rockfish | 33.1 |
| Rougheye rockfish | 4.3 |
| **Flatfish** | |
| Dover sole | 26.3 |
| Deepsea sole | 1.2 |
| **Roundfish** | |
| Sablefish | 24.4 |
| Pacific hake | 7.3 |
| **Elasmobranchs** | |
| Pacific sleeper shark | 20.3 |
| **Miscellaneous fish** | |
| Roughscale rattail | 13.3 |
| Pacific flatnose | 3.2 |
| Blacktail snailfish | 0.3 |
| Northern lampfish | |
| **Invertebrates** | |
| Zoantharia | 7.0 |
| Gorgonian corals | 3.2 |
| Schoolmaster gonate squid | 2.6 |
| Tanner crabs | 2.2 |
| Octopus | 0.3 |
| Anemone | |
| Sand star | |
| Echinasteridae | |
| **Other items** | |
| Inanimate object(s) | 5.0 |
| **TOTAL** | **419.2 kg** |

## Appendix E (continued)

| Set : | 52 | Date: 15/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 56 | Duration (min) : 60 |
| Hdline Hgt (m): | 2.8 | Distance (km) : 4.94 |
| Door sprd (m): | 58.9 | Speed (km/h) : 4.94 |

| | Start | Finish |
|---|---|---|
| Time : | 16:09 | 17:09 |
| Depth (m) : | 549 | 530 |
| Latitude : | 49° 56.50' | 49° 57.23' |
| Longitude : | 127° 59.60' | 128° 03.17' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 139.6 |
| Shortraker rockfish | 18.4 |
| Longspine thornyhead | 11.2 |
| Rougheye rockfish | 3.9 |
| Aurora rockfish | 0.6 |
| **Flatfish** | |
| Dover sole | 78.2 |
| Arrowtooth flounder | 3.7 |
| Rex sole | 2.5 |
| **Roundfish** | |
| Sablefish | 43.4 |
| Pacific hake | 8.5 |
| **Elasmobranchs** | |
| Longnose skate | 20.4 |
| **Miscellaneous fish** | |
| Pacific flatnose | 2.2 |
| Pectoral rattail | 0.9 |
| Black eelpout | 0.7 |
| Blacktail snailfish | |
| Viperfishes | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 2.6 |
| Tanner crabs | 1.9 |
| **Other Items** | |
| Inanimate object(s) | 1.0 |
| **TOTAL** | **339.7 kg** |

| Set : | 53 | Date: 15/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 54 | Duration (min) : 58 |
| Hdline Hgt (m): | 3.1 | Distance (km) : 5.14 |
| Door sprd (m): | 58.5 | Speed (km/h) : 5.31 |

| | Start | Finish |
|---|---|---|
| Time : | 17:56 | 18:54 |
| Depth (m) : | 594 | 604 |
| Latitude : | 49° 55.25' | 49° 55.24' |
| Longitude : | 128° 01.77' | 127° 57.54' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 150.6 |
| Longspine thornyhead | 13.5 |
| Rougheye rockfish | 0.5 |
| **Flatfish** | |
| Dover sole | 83.0 |
| Arrowtooth flounder | 9.2 |
| Deepsea sole | 1.1 |
| Rex sole | 0.7 |
| **Roundfish** | |
| Sablefish | 36.0 |
| Pacific hake | 9.9 |
| **Elasmobranchs** | |
| Longnose skate | 5.5 |
| **Miscellaneous fish** | |
| Pacific flatnose | 3.2 |
| Pectoral rattail | 2.7 |
| Lanternfishes | 0.1 |
| Deepsea smelts | 0.1 |
| Blacktail snailfish | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 11.0 |
| Tanner crabs | 5.0 |
| Shrimp | |
| **TOTAL** | **332.2 kg** |

| Set : | 54 | Date: 15/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 60 | Duration (min) : 60 |
| Hdline Hgt (m): | 3.0 | Distance (km) : 4.71 |
| Door sprd (m): | 59.8 | Speed (km/h) : 4.71 |

| | Start | Finish |
|---|---|---|
| Time : | 20:48 | 21:48 |
| Depth (m) : | 924 | 841 |
| Latitude : | 49° 49.62' | 49° 48.25' |
| Longitude : | 127° 56.52' | 127° 53.31' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 80.3 |
| Shortspine thornyhead | 61.7 |
| Shortraker rockfish | 3.3 |
| **Flatfish** | |
| Dover sole | 7.2 |
| Deepsea sole | 2.7 |
| **Roundfish** | |
| Sablefish | 33.8 |
| Pacific hake | 3.4 |
| **Elasmobranchs** | |
| Longnose skate | 17.0 |
| **Miscellaneous fish** | |
| Pectoral rattail | 13.5 |
| Pacific flatnose | 2.2 |
| Filamented rattail | 2.2 |
| Slickheads | 0.5 |
| Roughscale rattail | 0.3 |
| Blacktail snailfish | 0.3 |
| Twoline eelpout | 0.2 |
| Bigfin eelpout | 0.2 |
| Deepsea smelts | 0.2 |
| Lanternfishes | 0.1 |
| **Invertebrates** | |
| Tanner crabs | 5.7 |
| Schoolmaster gonate squid | 2.0 |
| Zoantharia | 0.4 |
| Solasteridae | 0.2 |
| **Other items** | |
| Fish eggs | |
| **TOTAL** | **237.5 kg** |

## Appendix E (continued)

| Set : | 55 | Date: 16/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 39 | Duration (min) : 43 |
| Hdline Hgt (m): | 3.3 | Distance (km) : 3.56 |
| Door sprd (m): | 62.3 | Speed (km/h) : 4.97 |

| | Start | Finish |
|---|---|---|
| Time : | 7:52 | 8:35 |
| Depth (m) : | 549 | 494 |
| Latitude : | 49° 56.59' | 49° 55.89' |
| Longitude : | 127° 59.22' | 128° 01.69' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 85.8 |
| Shortraker rockfish | 38.9 |
| Longspine thornyhead | 6.2 |
| Aurora rockfish | 0.8 |
| **Flatfish** | |
| Dover sole | 53.9 |
| Arrowtooth flounder | 23.8 |
| Rex sole | 5.7 |
| **Roundfish** | |
| Sablefish | 48.7 |
| Pacific hake | 2.8 |
| **Miscellaneous fish** | |
| Filamented rattail | 1.9 |
| Pacific flatnose | 0.7 |
| Roughscale rattail | 0.5 |
| Viperfishes | 0.0 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 7.0 |
| Tanner crabs | 4.0 |
| Primnoa | 0.3 |
| Gorgonian corals | 0.0 |
| Solasteridae | 0.0 |
| Seaslugs | |
| **TOTAL** | **281.1 kg** |

| Set : | 56 | Date: 16/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 50 | Duration (min) : 50 |
| Hdline Hgt (m): | 3.2 | Distance (km) : 3.71 |
| Door sprd (m): | 59.8 | Speed (km/h) : 4.45 |

| | Start | Finish |
|---|---|---|
| Time : | 9:47 | 10:37 |
| Depth (m) : | 516 | 521 |
| Latitude : | 49° 56.02' | 49° 57.08' |
| Longitude : | 128° 00.38' | 128° 03.02' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 111.7 |
| Shortraker rockfish | 40.9 |
| Rougheye rockfish | 4.4 |
| **Flatfish** | |
| Dover sole | 75.4 |
| Arrowtooth flounder | 24.8 |
| Rex sole | 19.9 |
| **Roundfish** | |
| Sablefish | 13.4 |
| Pacific hake | 6.5 |
| **Elasmobranchs** | |
| Longnose skate | 82.9 |
| **Miscellaneous fish** | |
| Pacific flatnose | 2.0 |
| Lumpfishes and snailfishes | |
| Bigfin eelpout | |
| **Invertebrates** | |
| Tanner crabs | 2.8 |
| Schoolmaster gonate squid | 2.4 |
| **TOTAL** | **387.3 kg** |

| Set : | 57 | Date: 16/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 801-1200 |
| **Usable :** | **NO** | Major/Minor : 04 26 |
| Contact (min) : | | Duration (min) : |
| Hdline Hgt (m): | | Distance (km) : |
| Door sprd (m): | | Speed (km/h) : |

| | Start | Finish |
|---|---|---|
| Time : | 17:45 | 17:50 |
| Depth (m) : | 604 | |
| Latitude : | 49° 31.13' | |
| Longitude : | 128° 39.35' | |

** Catch was not sampled **

## Appendix E (continued)

| Set : | 58 | Date: 16/09/2003 |
|---|---|---|
| Region : | D | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 43 | Duration (min) : 55 |
| Hdline Hgt (m): | 3.6 | Distance (km) : 3.93 |
| Door sprd (m): | 63.1 | Speed (km/h) : 4.29 |

| | Start | Finish |
|---|---|---|
| Time : | 22:37 | 23:32 |
| Depth (m) : | 1298 | 1262 |
| Latitude : | 49° 24.73' | 49° 22.72' |
| Longitude : | 127° 31.48' | 127° 31.18' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 28.9 |
| Shortspine thornyhead | 2.2 |
| **Flatfish** | |
| Deepsea sole | 0.5 |
| **Elasmobranchs** | |
| Abyssal skate | 2.8 |
| **Miscellaneous fish** | |
| Roughscale rattail | 207.9 |
| Pectoral rattail | 104.7 |
| Giant blobsculpin | 5.1 |
| Pacific flatnose | 5.1 |
| Filamented rattail | 1.3 |
| Deepsea smelts | 0.1 |
| Northern lampfish | |
| Bigfin eelpout | |
| **Invertebrates** | |
| Tanner crabs | 3.2 |
| Schoolmaster gonate squid | 1.0 |
| Anemone | 1.0 |
| Echinasteridae | 0.5 |
| Shrimp | 0.1 |
| Gorgonian corals | 0.0 |
| Brittle stars | |
| Gastropods | |
| Sea whip | |
| **TOTAL** | **364.3 kg** |

| Set : | 59 | Date: 17/09/2003 |
|---|---|---|
| Region : | D | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 80 | Duration (min) : 74 |
| Hdline Hgt (m): | 3.2 | Distance (km) : 5.51 |
| Door sprd (m): | 54.3 | Speed (km/h) : 4.46 |

| | Start | Finish |
|---|---|---|
| Time : | 7:25 | 8:39 |
| Depth (m) : | 896 | 896 |
| Latitude : | 49° 30.13' | 49° 30.65' |
| Longitude : | 127° 28.16' | 127° 23.57' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 173.9 |
| Shortspine thornyhead | 18.1 |
| **Flatfish** | |
| Deepsea sole | 4.5 |
| **Roundfish** | |
| Sablefish | 16.7 |
| **Elasmobranchs** | |
| Sandpaper skate | 11.2 |
| Abyssal skate | 2.3 |
| Roughtail skate | 0.1 |
| **Miscellaneous fish** | |
| Roughscale rattail | 53.6 |
| Pectoral rattail | 10.1 |
| Slickheads | 3.4 |
| Twoline eelpout | 1.7 |
| Bigfin eelpout | 1.3 |
| Filamented rattail | 0.7 |
| Pacific flatnose | 0.4 |
| Lumpfishes and snailfishes | 0.3 |
| Popeye | 0.2 |
| Northern lampfish | 0.1 |
| **Invertebrates** | |
| Tanner crabs | 22.5 |
| Vampire squid | 3.7 |
| Spiny red sea star | 1.5 |
| Solasteridae | 1.0 |
| Glass sponges | 1.0 |
| Echinasteridae | 0.6 |
| Sand star | 0.5 |
| Sea cucumber | 0.4 |
| Gastropods | 0.1 |
| Primnoa | 0.1 |
| True crabs | 0.1 |
| Anemone | |
| Pacific lyre crab | |
| Seaslugs | |
| Shrimp | |
| **Other items** | |
| Fish eggs | 0.2 |
| **TOTAL** | **330.3 kg** |

| Set : | 60 | Date: 17/09/2003 |
|---|---|---|
| Region : | D | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 25 |
| Contact (min) : | 57 | Duration (min) : 62 |
| Hdline Hgt (m): | 3.3 | Distance (km) : 4.49 |
| Door sprd (m): | 59.3 | Speed (km/h) : 4.35 |

| | Start | Finish |
|---|---|---|
| Time : | 10:03 | 11:05 |
| Depth (m) : | 988 | 1024 |
| Latitude : | 49° 33.19' | 49° 31.19' |
| Longitude : | 127° 21.32' | 127° 23.24' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 156.9 |
| Shortspine thornyhead | 17.6 |
| **Flatfish** | |
| Deepsea sole | 4.8 |
| Dover sole | 3.8 |
| **Roundfish** | |
| Sablefish | 58.7 |
| **Elasmobranchs** | |
| Brown cat shark | 0.7 |
| **Miscellaneous fish** | |
| Roughscale rattail | 10.1 |
| Pectoral rattail | 7.4 |
| Twoline eelpout | 4.6 |
| Filamented rattail | 4.3 |
| Popeye | 3.1 |
| Pacific flatnose | 0.8 |
| Pacific hagfish | 0.6 |
| Slickheads | 0.6 |
| Northern lampfish | |
| **Invertebrates** | |
| Tanner crabs | 5.1 |
| Schoolmaster gonate squid | 1.5 |
| Glass sponges | 0.7 |
| Solasteridae | 0.5 |
| Spiny red sea star | 0.2 |
| **TOTAL** | **281.9 kg** |

## Appendix E (continued)

| Set : | 61 | Date: 18/09/2003 | |
|---|---|---|---|
| Region : | D | Dep Zone: | 501-800 |
| **Usable :** | **yes** | Major/Minor : | 04 25 |
| Contact (min) : | 73 | Duration (min) : | 80 |
| Hdline Hgt (m): | 3.7 | Distance (km) : | 6.33 |
| Door sprd (m): | 60.1 | Speed (km/h) : | 4.75 |

| | Start | Finish |
|---|---|---|
| Time : | 12:17 | 13:37 |
| Depth (m) : | 640 | 640 |
| Latitude : | 49° 36.74' | 49° 35.52' |
| Longitude : | 127° 26.97' | 127° 22.26' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 70.6 |
| Longspine thornyhead | 65.5 |
| Shortraker rockfish | 3.3 |
| **Flatfish** | |
| Dover sole | 29.3 |
| Deepsea sole | 1.8 |
| **Roundfish** | |
| Sablefish | 132.1 |
| Pacific hake | 5.0 |
| **Elasmobranchs** | |
| Brown cat shark | 1.0 |
| **Miscellaneous fish** | |
| Filamented rattail | 3.9 |
| Pacific flatnose | 3.2 |
| Popeye | 2.8 |
| Roughscale rattail | 1.5 |
| Pectoral rattail | 1.0 |
| Bigfin eelpout | 0.4 |
| Blacktail snailfish | 0.2 |
| Twoline eelpout | 0.1 |
| Northern lampfish | 0.1 |
| Bigeye poacher | |
| **Invertebrates** | |
| Tanner crabs | 11.5 |
| Schoolmaster gonate squid | 10.4 |
| Solasteridae | 0.6 |
| Spiny red sea star | 0.2 |
| Squat lobster | 0.0 |
| Jellyfish | |
| **TOTAL** | **344.5 kg** |

| Set : | 62 | Date: 18/09/2003 | |
|---|---|---|---|
| Region : | D | Dep Zone: | 501-800 |
| **Usable :** | **yes** | Major/Minor : | 04 26 |
| Contact (min) : | 66 | Duration (min) : | 61 |
| Hdline Hgt (m): | 3.3 | Distance (km) : | 4.72 |
| Door sprd (m): | 58.6 | Speed (km/h) : | 4.64 |

| | Start | Finish |
|---|---|---|
| Time : | 15:16 | 16:17 |
| Depth (m) : | 589 | 501 |
| Latitude : | 49° 39.69' | 49° 37.70' |
| Longitude : | 127° 27.27' | 127° 24.99' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 122.0 |
| Shortraker rockfish | 82.3 |
| Splitnose rockfish | 0.1 |
| **Flatfish** | |
| Dover sole | 124.7 |
| Arrowtooth flounder | 27.9 |
| **Roundfish** | |
| Sablefish | 517.7 |
| Pacific hake | 10.5 |
| **Elasmobranchs** | |
| Longnose skate | 17.4 |
| Brown cat shark | 1.7 |
| Sandpaper skate | 0.9 |
| **Miscellaneous fish** | |
| Pacific flatnose | 4.7 |
| Black eelpout | 2.2 |
| Pectoral rattail | 1.5 |
| Blacktail snailfish | 0.1 |
| Blackfin poacher | 0.1 |
| **Invertebrates** | |
| Schoolmaster gonate squid | 39.0 |
| Anemone | 1.5 |
| Glass sponges | 1.0 |
| Octopus | 0.8 |
| Tanner crabs | 0.7 |
| Solasteridae | 0.5 |
| Sand star | 0.2 |
| Spiny red sea star | 0.1 |
| Gastropods | |
| **TOTAL** | **957.6 kg** |

| Set : | 63 | Date: 18/09/2003 | |
|---|---|---|---|
| Region : | D | Dep Zone: | 501-800 |
| **Usable :** | **yes** | Major/Minor : | 04 26 |
| Contact (min) : | 74 | Duration (min) : | 66 |
| Hdline Hgt (m): | 3.1 | Distance (km) : | 5.03 |
| Door sprd (m): | 58.3 | Speed (km/h) : | 4.57 |

| | Start | Finish |
|---|---|---|
| Time : | 17:20 | 18:26 |
| Depth (m) : | 604 | 658 |
| Latitude : | 49° 38.36' | 49° 39.43' |
| Longitude : | 127° 25.97' | 127° 29.91' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 83.0 |
| Shortraker rockfish | 18.9 |
| Longspine thornyhead | 17.6 |
| Pacific ocean perch | 1.8 |
| Splitnose rockfish | 0.4 |
| **Flatfish** | |
| Dover sole | 88.2 |
| Arrowtooth flounder | 18.4 |
| **Roundfish** | |
| Sablefish | 513.6 |
| Pacific hake | 3.4 |
| **Elasmobranchs** | |
| Longnose skate | 26.6 |
| Abyssal skate | 3.2 |
| Brown cat shark | 3.0 |
| **Miscellaneous fish** | |
| Pacific flatnose | 6.0 |
| Pectoral rattail | 4.4 |
| Blacktail snailfish | 1.7 |
| Black eelpout | 1.3 |
| Twoline eelpout | 0.9 |
| Filamented rattail | 0.4 |
| Blackfin poacher | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 46.1 |
| Octopus | 2.7 |
| Vampire squid | 1.2 |
| Anemone | 0.6 |
| Tanner crabs | 0.5 |
| Sand star | 0.4 |
| Solasteridae | 0.2 |
| Heart urchins | |
| **TOTAL** | **844.6 kg** |

## Appendix E (continued)

| Set : | 64 | Date: 18/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 801-1200 |
| **Usable :** | **NO** | Major/Minor : 04 26 |
| Contact (min) : | | Duration (min) : |
| Hdline Hgt (m): | | Distance (km) : |
| Door sprd (m): | | Speed (km/h) : |

| | Start | Finish |
|---|---|---|
| Time : | 20:57 | 21:05 |
| Depth (m) : | 933 | 942 |
| Latitude : | 49° 29.63' | 49° 29.82' |
| Longitude : | 127° 38.52' | 127° 38.69' |

** Catch was not sampled **

| Set : | 65 | Date: 18/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 74 | Duration (min) : 71 |
| Hdline Hgt (m): | 3.2 | Distance (km) : 5.50 |
| Door sprd (m): | 61.4 | Speed (km/h) : 4.65 |

| | Start | Finish |
|---|---|---|
| Time : | 22:19 | 23:30 |
| Depth (m) : | 933 | 924 |
| Latitude : | 49° 29.26' | 49° 31.88' |
| Longitude : | 127° 38.03' | 127° 40.12' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 66.3 |
| Shortspine thornyhead | 38.7 |
| Shortraker rockfish | 10.6 |
| **Flatfish** | |
| Deepsea sole | 4.5 |
| **Roundfish** | |
| Sablefish | 14.4 |
| **Elasmobranchs** | |
| Brown cat shark | 0.3 |
| **Miscellaneous fish** | |
| Pectoral rattail | 24.8 |
| Roughscale rattail | 16.4 |
| Slickheads | 5.2 |
| Twoline eelpout | 4.5 |
| Filamented rattail | 2.7 |
| Pacific flatnose | 1.3 |
| Black eelpout | 0.3 |
| Northern lampfish | 0.1 |
| Pacific hagfish | 0.1 |
| Snailfishes | |
| Bigfin eelpout | |
| Viperfishes | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 5.3 |
| Tanner crabs | 4.0 |
| Octopus | 1.2 |
| Vampire squid | 0.7 |
| Anemone | 0.5 |
| Red king crab | 0.1 |
| Sand star | 0.1 |
| **TOTAL** | **202.0 kg** |

| Set : | 66 | Date: 19/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 74 | Duration (min) : 70 |
| Hdline Hgt (m): | 4.0 | Distance (km) : 5.20 |
| Door sprd (m): | 59.1 | Speed (km/h) : 4.46 |

| | Start | Finish |
|---|---|---|
| Time : | 6:40 | 7:50 |
| Depth (m) : | 997 | 988 |
| Latitude : | 49° 30.59' | 49° 32.87' |
| Longitude : | 127° 40.46' | 127° 42.68' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 184.0 |
| Shortspine thornyhead | 24.0 |
| **Flatfish** | |
| Deepsea sole | 1.8 |
| **Roundfish** | |
| Sablefish | 22.3 |
| **Miscellaneous fish** | |
| Roughscale rattail | 61.9 |
| Pectoral rattail | 20.8 |
| Slickheads | 8.4 |
| Filamented rattail | 4.5 |
| Pacific flatnose | 0.5 |
| **Invertebrates** | |
| Tanner crabs | 5.2 |
| Anemone | 1.2 |
| Red king crab | |
| Lithodes couesi | |
| Jellyfish | |
| Gastropods | |
| **TOTAL** | **334.7 kg** |

## Appendix E (continued)

| Set : | 67 | Date: 19/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 801-1200 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 75 | Duration (min) : 74 |
| Hdline Hgt (m): | 3.3 | Distance (km) : 5.62 |
| Door sprd (m): | 61.1 | Speed (km/h) : 4.56 |

| | Start | Finish |
|---|---|---|
| Time : | 9:06 | 10:20 |
| Depth (m) : | 1097 | 878 |
| Latitude : | 49° 32.23' | 49° 33.98' |
| Longitude : | 127° 37.05' | 127° 40.89' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 94.7 |
| Shortspine thornyhead | 50.5 |
| **Flatfish** | |
| Deepsea sole | 2.0 |
| **Roundfish** | |
| Sablefish | 76.1 |
| **Elasmobranchs** | |
| Brown cat shark | 0.8 |
| **Miscellaneous fish** | |
| Roughscale rattail | 38.8 |
| Pectoral rattail | 11.0 |
| Filamented rattail | 6.6 |
| Pacific flatnose | 1.2 |
| Twoline eelpout | 1.1 |
| Popeye | 1.0 |
| Bigfin eelpout | 0.3 |
| Slickheads | 0.2 |
| Deepsea smelts | 0.2 |
| Pacific hagfish | 0.2 |
| Northern lampfish | 0.1 |
| Lanternfishes | 0.1 |
| **Invertebrates** | |
| Tanner crabs | 6.0 |
| Glass sponges | 1.2 |
| Sand star | 0.1 |
| Squat lobster | |
| **TOTAL** | **292.1 kg** |

| Set : | 68 | Date: 19/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 59 | Duration (min) : 66 |
| Hdline Hgt (m): | 2.9 | Distance (km) : 4.53 |
| Door sprd (m): | 59.8 | Speed (km/h) : 4.12 |

| | Start | Finish |
|---|---|---|
| Time : | 11:34 | 12:40 |
| Depth (m) : | 1280 | 1244 |
| Latitude : | 49° 30.38' | 49° 31.80' |
| Longitude : | 127° 42.22' | 127° 44.93' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 27.8 |
| Shortspine thornyhead | 7.8 |
| **Flatfish** | |
| Deepsea sole | 2.9 |
| **Elasmobranchs** | |
| Abyssal skate | 2.4 |
| **Miscellaneous fish** | |
| Pectoral rattail | 126.2 |
| Roughscale rattail | 87.9 |
| Pacific flatnose | 10.9 |
| Filamented rattail | 2.9 |
| Popeye | 1.1 |
| Twoline eelpout | 0.9 |
| **Invertebrates** | |
| Vampire squid | 1.5 |
| Tanner crabs | 1.3 |
| Jellyfish | 0.1 |
| Shrimp | 0.0 |
| Solasteridae | 0.0 |
| **TOTAL** | **273.4 kg** |

| Set : | 69 | Date: 19/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 1201-1600 |
| **Usable :** | **NO** | Major/Minor : 04 26 |
| Contact (min) : | | Duration (min) : |
| Hdline Hgt (m): | | Distance (km) : |
| Door sprd (m): | | Speed (km/h) : |

| | Start | Finish |
|---|---|---|
| Time : | 15:43 | 15:56 |
| Depth (m) : | 1372 | 1737 |
| Latitude : | 49° 38.17' | 49° 38.61' |
| Longitude : | 127° 50.51' | 127° 50.09' |

** Catch was not sampled **

## Appendix E (continued)

| Set : | 70 | Date: 19/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 1201-1600 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 64 | Duration (min) : 82 |
| Hdline Hgt (m): | 3.7 | Distance (km) : 5.28 |
| Door sprd (m): | 56.8 | Speed (km/h) : 3.86 |

| | Start | Finish |
|---|---|---|
| Time : | 18:26 | 19:48 |
| Depth (m) : | 1317 | 1289 |
| Latitude : | 49° 27.92' | 49° 30.48' |
| Longitude : | 127° 40.44' | 127° 42.28' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Longspine thornyhead | 17.7 |
| Shortspine thornyhead | 7.5 |
| **Flatfish** | |
| Deepsea sole | 4.0 |
| **Roundfish** | |
| Sablefish | 14.0 |
| **Elasmobranchs** | |
| Abyssal skate | 26.3 |
| Sandpaper skate | 0.5 |
| **Miscellaneous fish** | |
| Roughscale rattail | 310.1 |
| Pectoral rattail | 266.4 |
| Pacific flatnose | 40.0 |
| Filamented rattail | 6.2 |
| Popeye | 4.2 |
| Twoline eelpout | 2.4 |
| Lumpfishes and snailfishes | 0.5 |
| Slickheads | 0.5 |
| Northern lampfish | |
| **Invertebrates** | |
| Octopus | 5.1 |
| Vampire squid | 3.4 |
| Tanner crabs | 0.7 |
| Schoolmaster gonate squid | 0.5 |
| Glass sponges | 0.2 |
| Spiny red sea star | 0.1 |
| Primnoa | |
| Anemone | |
| Echinasteridae | |
| Solasteridae | |
| Seaslugs | |
| **Other items** | |
| Inanimate object(s) | 0.9 |
| Unidentified organic matter | |
| **TOTAL** | **711.3 kg** |

| Set : | 71 | Date: 19/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 66 | Duration (min) : 68 |
| Hdline Hgt (m): | 3.0 | Distance (km) : 6.58 |
| Door sprd (m): | 62.3 | Speed (km/h) : 5.81 |

| | Start | Finish |
|---|---|---|
| Time : | 22:45 | 23:53 |
| Depth (m) : | 613 | 594 |
| Latitude : | 49° 43.26' | 49° 39.73' |
| Longitude : | 127° 36.99' | 127° 37.31' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 57.0 |
| Rougheye rockfish | 1.4 |
| **Flatfish** | |
| Dover sole | 45.2 |
| Arrowtooth flounder | 1.9 |
| **Roundfish** | |
| Sablefish | 92.3 |
| Pacific hake | 7.4 |
| **Miscellaneous fish** | |
| Pectoral rattail | 7.6 |
| Pacific flatnose | 5.6 |
| Roughscale rattail | 2.9 |
| Twoline eelpout | 1.2 |
| Filamented rattail | 0.3 |
| Lanternfishes | 0.0 |
| **Invertebrates** | |
| Squids | 3.5 |
| Tanner crabs | 1.6 |
| Shrimp | |
| **TOTAL** | **227.8 kg** |

| Set : | 72 | Date: 20/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 56 | Duration (min) : 55 |
| Hdline Hgt (m): | 2.8 | Distance (km) : 4.88 |
| Door sprd (m): | 60.8 | Speed (km/h) : 5.32 |

| | Start | Finish |
|---|---|---|
| Time : | 6:46 | 7:41 |
| Depth (m) : | 713 | 677 |
| Latitude : | 49° 54.77' | 49° 55.42' |
| Longitude : | 127° 59.78' | 127° 55.58' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 115.8 |
| Longspine thornyhead | 28.6 |
| **Flatfish** | |
| Dover sole | 67.6 |
| **Roundfish** | |
| Sablefish | 82.3 |
| Pacific hake | 2.8 |
| **Elasmobranchs** | |
| Longnose skate | 6.8 |
| **Miscellaneous fish** | |
| Pectoral rattail | 4.1 |
| Pacific flatnose | 1.8 |
| Black eelpout | 1.1 |
| Slender codling | 0.6 |
| Filamented rattail | 0.3 |
| Blackfin poacher | |
| Blacktail snailfish | |
| Deepsea smelts | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 9.2 |
| Spiny red sea star | 0.1 |
| Echinasteridae | 0.1 |
| **Other items** | |
| Unidentified organic matter | |
| **TOTAL** | **321.1 kg** |

## Appendix E (continued)

| Set : | 73 | Date: 20/09/2003 |
|---|---|---|
| Region : | F | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 49 | Duration (min) : 43 |
| Hdline Hgt (m): | 3.0 | Distance (km) : 3.32 |
| Door sprd (m): | 61.9 | Speed (km/h) : 4.64 |

| | Start | Finish |
|---|---|---|
| Time : | 10:50 | 11:33 |
| Depth (m) : | 594 | 549 |
| Latitude : | 49° 56.04' | 49° 57.18' |
| Longitude : | 128° 3.510' | 128° 5.710' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 198.2 |
| Shortraker rockfish | 32.8 |
| Longspine thornyhead | 16.8 |
| Rougheye rockfish | 2.4 |
| **Flatfish** | |
| Dover sole | 137.0 |
| Arrowtooth flounder | 3.7 |
| Rex sole | 1.8 |
| Deepsea sole | 1.5 |
| **Roundfish** | |
| Sablefish | 14.5 |
| Pacific hake | 8.4 |
| **Miscellaneous fish** | |
| Pacific flatnose | 3.9 |
| Filamented rattail | 1.7 |
| Twoline eelpout | |
| **Invertebrates** | |
| Schoolmaster gonate squid | 2.6 |
| Tanner crabs | 1.3 |
| Solasteridae | |
| Spiny red sea star | |
| **Other Items** | |
| Inanimate object(s) | 5.7 |
| **TOTAL** | **432.5 kg** |

| Set : | 74 | Date: 20/09/2003 |
|---|---|---|
| Region : | E | Dep Zone: 501-800 |
| **Usable :** | **yes** | Major/Minor : 04 26 |
| Contact (min) : | 56 | Duration (min) : 58 |
| Hdline Hgt (m): | 2.9 | Distance (km) : 4.58 |
| Door sprd (m): | 64.3 | Speed (km/h) : 4.74 |

| | Start | Finish |
|---|---|---|
| Time : | 15:01 | 15:59 |
| Depth (m) : | 631 | 783 |
| Latitude : | 49° 36.03' | 49° 37.43' |
| Longitude : | 127° 39.10' | 127° 42.21' |

| Species | Wgt (kg) |
|---|---|
| **Rockfish** | |
| Shortspine thornyhead | 78.0 |
| Shortraker rockfish | 21.2 |
| Longspine thornyhead | 11.5 |
| **Flatfish** | |
| Dover sole | 24.2 |
| **Roundfish** | |
| Sablefish | 31.7 |
| Pacific hake | 4.0 |
| **Elasmobranchs** | |
| Abyssal skate | 4.8 |
| **Miscellaneous fish** | |
| Pacific flatnose | 4.2 |
| Pectoral rattail | 2.9 |
| Twoline eelpout | 1.5 |
| Filamented rattail | 1.3 |
| Roughscale rattail | 0.2 |
| Lanternfishes | |
| **Invertebrates** | |
| Tanner crabs | 2.5 |
| Schoolmaster gonate squid | 1.2 |
| Lithodes couesi | 0.5 |
| **TOTAL** | **189.7 kg** |

**APPENDIX E** (continued).

Notes pertaining to haul information:

**Dep Zone**: depth stratum limits (metres).

**Usable**: indicates whether the tow was considered usable for biomass estimation.

**Major/Minor**: Major and Minor Statistical Area codes used for DFO groundfish management purposes.

**Contact**: bottom contact time (minutes) is the elapsed time between first net contact with bottom after winch lockup to last contact with bottom following winch release as the net was retrieved. These start/end times were based on tilt angle changes using 45° as the cutoff angle between vertical and horizontal sensor orientation.

**Duration**: elapsed time (minutes) between winch lockup as the fishing event begins until the time that the winch is released to start retrieving the gear.

**Hdline Hgt**: mean height (metres) of the headline above the footrope, based on interval data from winch lockup to winch release during each tow.

**Distance**: estimated distance (kilometres) that the gear was towed along bottom, calculated using interval distances estimated from winch lockup to winch release during each tow (see Eq. 3).

**Door sprd**: median distance (metres) between the trawl doors, measured by Scanmar distance sensor readings from live-feed and screen-capture data.

**Speed**: average vessel speed (km/h) during the tow based on interval data from winch lockup to winch release, using Scanmar screen captures (tows 1-36, 51, 72) and live data feeds (tows 37-74 except 51 and 72).

**APPENDIX F.** Date, time and position information added to existing Nobeltec track data to correspond with time and location recorded on bridge logs for winch lockup and/or winch release. Original Nobeltec track start/end points for these tows differed from bridge logs when the skipper failed to activate track recording at the required time.

| Tow | Date | Local Time | Latitude (decimal degrees) | Longitude (decimal degrees) |
|---|---|---|---|---|
| 4 | September 5, 2003 | 14:13:00 | 48.302 | 126.065 |
| 5 | September 5, 2003 | 17:27:20 | 48.415 | 126.359 |
| 6 | September 5, 2003 | 23:20:00 | 48.499 | 126.342 |
| 8 | September 6, 2003 | 08:51:00 | 48.417 | 126.205 |
| 9 | September 6, 2003 | 11:28:00 | 48.538 | 126.295 |
| 10 | September 6, 2003 | 15:25:00 | 48.469 | 126.215 |
| 11 | September 6, 2003 | 17:49:00 | 48.542 | 126.300 |
| 13 | September 7, 2003 | 08:48:00 | 48.674 | 126.893 |
| 14 | September 7, 2003 | 13:30:00 | 48.904 | 126.588 |
| 15 | September 7, 2003 | 16:55:00 | 48.859 | 126.618 |
| 15 | September 7, 2003 | 18:08:00 | 48.895 | 126.568 |
| 16 | September 7, 2003 | 21:08:00 | 48.731 | 126.538 |
| 19 | September 8, 2003 | 10:27:00 | 48.591 | 126.505 |
| 23 | September 9, 2003 | 16:58:00 | 48.996 | 126.961 |
| 27 | September 10, 2003 | 06:39:00 | 49.149 | 127.026 |
| 29 | September 10, 2003 | 11:02:00 | 49.206 | 127.115 |
| 31 | September 10, 2003 | 16:27:00 | 49.184 | 127.277 |
| 35 | September 11, 2003 | 12:31:00 | 49.424 | 127.300 |
| 35 | September 11, 2003 | 12:49:00 | 49.419 | 127.317 |
| 37 | September 12, 2003 | 15:57:00 | 50.367 | 128.487 |
| 38 | September 12, 2003 | 19:05:00 | 50.330 | 128.393 |
| 43 | September 14, 2003 | 06:40:00 | 50.239 | 128.321 |
| 44 | September 14, 2003 | 10:20:00 | 50.183 | 128.411 |
| 45 | September 14, 2003 | 13:13:00 | 50.254 | 128.468 |
| 45 | September 14, 2003 | 13:35:16 | 50.253 | 128.482 |
| 48 | September 14, 2003 | 22:46:00 | 50.266 | 128.701 |
| 51 | September 15, 2003 | 12:51:00 | 49.940 | 128.083 |
| 52 | September 15, 2003 | 16:09:00 | 49.942 | 127.993 |
| 55 | September 16, 2003 | 08:35:00 | 49.932 | 128.028 |
| 59 | September 17, 2003 | 07:25:00 | 49.502 | 127.469 |
| 64 | September 18, 2003 | 20:57:00 | 49.494 | 127.642 |
| 64 | September 18, 2003 | 21:05:00 | 49.497 | 127.645 |
| 66 | September 19, 2003 | 07:50:00 | 49.548 | 127.711 |
| 69 | September 19, 2003 | 15:43:00 | 49.636 | 127.842 |
| 69 | September 19, 2003 | 15:56:00 | 49.643 | 127.835 |
| 70 | September 19, 2003 | 19:48:00 | 49.508 | 127.705 |
| 71 | September 19, 2003 | 22:45:00 | 49.721 | 127.616 |